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NUCLEAR SCIENCE ABSTRACTS

Volume 11 April 30, 1957 No. 8

GENERAL

ATOMIC BOMBS AND WARFARE

4217 AERE-HP/M-27

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

NEUTRON INDUCED ACTIVITY FOLLOWING AN ATOMIC EXPLOSION. G. H. Stafford. Aug. 1951. Decl. Dec. 20, 1956. 9p.

The effect of neutron induced activity following an atomic explosion has been calculated on the basis of information available in the publication "The Effects of Atomic Explosions." For an air burst, soil of average composition is made measurably radioactive by the 0.2% sodium present At ground zero this activity amounts to only 0.26 r per hr. The activity induced in the common metals is negligible. In both a ground burst and an underwater burst deposited fission product activity completely dominates the induced activities. (auth)

4218 USNRDL-TR-132

Naval Radiological Defense Lab., San Francisco.

PERFORMANCE SPECIFICATIONS FOR A SOUND NATIONAL SHELTER SYSTEM. W. E. Strope. Feb. 13, 1957. 28p. Project NS 083-001.

The urgent need for a national shelter program because of the advance of megaton nuclear weapons and guided missile delivery systems is pointed out. Conclusions, based on five years of military atomic defense studies are presented regarding shelter performance specifications and estimated cost for a sound and feasible national shelter program. (auth)

ATOMIC POWER

4219

SOME PEACEFUL USES OF ATOMIC ENERGY. W. Kenneth Davis (Atomic Energy Commission); Shields Warren (New England Deaconess Hospital, Boston, Mass) and Walker L. Cisler (Detroit Edison Co., Mich.). Sci. Monthly 83, 287-97 (1956) Dec.

4220

RADIATION SAFETY AND MAJOR ACTIVITIES IN THE ATOMIC ENERGY PROGRAMS, JULY–DECEMBER 1956. Washington, United States Government Printing Office, Jan. 1957. 412p. Price $1.25.

A summary is given of the activities of the various atomic energy programs of the AEC. A section on radiation safety in atomic energy activities is included. (T.R.H.)

Refer also to abstract 4681.

BIOLOGY AND MEDICINE

4221 UCRL-3534

California. Univ., Berkeley. Radiation Lab. and California. State Hospital, Stockton.

LONG-TERM EFFECT OF DESICCATED THYROID SUBSTANCE UPON SERUM LIPOPROTEINS AND SERUM CHOLESTEROL. Beverly Strisower, John W. Gofman, Elmer F. Galioni, Joshua H. Rubinger, Jean Pouteau, and Peter Guzvich. Sept. 28, 1956. 16p. Contract W-7405-Eng-48. $0.20(OTS).

4222 WADC-TR-56-273

National Research Council. Committee on the Handbook of Biological Data.

HANDBOOK OF BIOLOGICAL DATA. William S. Spector, ed. Oct. 1956. 620p. Project 7158. Contract AF33(038)-2174. (AD-110501).

4223

BIOLOGICAL ROLE OF POTASSIUM-40. A. P. Vinogradov (Academy of Sciences, Moscow). Nature 179, 308-9(1957) Feb. 9.

A study was made on Aspergillus niger in order to determine whether the presence of K^{40} in an organism has any significance in its life. It was shown that the growth of this organism preceeded in proportion to the concentration of K in the culture medium, regardless of isotopic composition. (B.J.H.)

RADIATION EFFECTS

4224 AFSWP-496

Smith (E. H.) and Co., Silver Spring, Md.

ANALYSIS OF ANIMAL WHOLE-BODY IRRADIATION DATA. 208p.

Data are reviewed from recent studies on both the chronic and acute effects of whole-body irradiation on laboratory animals. The accuracy of instrumentation, and the effects of backscatter, depth dosage, and radiation energy on radiation dosage determinations are considered. The effectiveness of various compounds in the prophylaxis and therapy of radiation injuries is discussed briefly. (C.H.)

4225 ATI-37462

California. Univ., Berkeley. Div. of Medical Physics.

IMMEDIATE AND DELAYED BIOCHEMICAL AND BIOLOGICAL EFFECTS OF IRRADIATION OF ANIMAL TISSUES. Status Report No. 3 [for] June 1947 to December 1947. 14p. Contract N6-ORI-III.

Methods which affect selective localization of radioactive compounds have been perfected for liver, spleen, and bone marrow. These are summarized with the status of the various investigations dealing with these specific irradiated tissues. A preliminary report of the effect of irradiation upon thyroid metabolism is attached, and it is noted that there is remarkably little effect upon iodine metabolism in the thyroid gland even with extreme irradiation dosages to the thyroid gland. (auth)

4226 NP-6199

Chicago. Univ. Air Force Radiation Lab.

QUARTERLY PROGRESS REPORT NO. 22. Jan. 15, 1957. 113p. Contract AF41(657)-25.

Progress is reported in the following studies: the toxic effects of various single doses of x radiation given to rats immediately following repeated exposures to 25 and 50 r per day; the effects of S,β-aminoethylisothiuronium dichloride, and β-mercaptoethylamine on succinic dehy-

drogenase activity of rat and mouse liver in vitro and in vivo and the effects of various sulfur-containing compounds singly and in combination on tyrosinase activity in vitro in mouse and rat liver; the effects of various steroids on the adenosine triphosphatase activity of the spleens and thymus glands of normal mice and a comparison of their effects with the action of x rays on this enzyme system; the survival time, weight loss, and mortality of mice treated with forty-four various chemical compounds before and following the administration of a lethal dose of whole-body x radiation; the effects of metallic ions on the survival time of mice given 800 r of total-body x radiation; the survival time of mice exposed to fractionated γ irradiation at dosage levels of 0.33, 1.0, and 3.0 rep/hr; and preliminary results from an investigation of the magnitude of the cage effect on the survival time of x-irradiated mice. (For preceding period see NP-6176.) (C.H.)

4227 UCRL-3573

California. Univ., Berkeley. Radiation Lab.
MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT [FOR] JULY, AUGUST, SEPTEMBER 1956. Nov. 1, 1956. 21p. Contract W-7405-eng-48. $0.25(OTS).

Progress is reported on the following studies: the effect of surgical and radiothyroidectomy-parathyroidectomy with I^{131} and At^{211} on breeding in the female rat; the tissue distribution of Sr^{90} in adult, young, and infant monkeys; the in vivo determination of whole-body retention of trace amounts of I^{131} in rats; the effect of thyroid-hormone therapy on health and longevity of rats receiving high levels of I^{131}; the radiation-induced oxidation of acetic acid-oxygen solutions; the radiation-induced reduction of formic acid in oxygen-free solution; the growth of ultraviolet-induced autotrophs of yeast; and heat inactivation of yeast. Routine health chemistry activities for the period are summarized. (For preceding period see UCRL-3386.) (C.H.)

4228 USNRDL-TR-124

Naval Radiological Defense Lab., San Francisco.
THE EFFECT OF X IRRADIATION UPON THE DIFFUSE ACTIVITY PERFORMANCE OF RATS, GUINEA PIGS, AND HAMSTERS. T. J. Castanera, D. C. Jones, and D. J. Kimeldorf. Nov. 30, 1956. 20p. Project No. NM-006-015.

4229

LENS CHANGES FOLLOWING X-IRRADIATION: OF SINGLE AND MULTIPLE QUADRANTS. R. D. Richards, E. F. Riley, and P. J. Leinfelder. Am. J. Ophthalmol. 42, No. 4, 44-51(1956) Oct.

4230

METABOLISM OF GLUCOSE AND FRUCTOSE IN LIVER OF THE RAT SUBJECTED TO WHOLE-BODY X-IRRADIATION. R. Hill, J. Kiyasu, and I. L. Chaikoff (Univ. of California School of Medicine, Berkeley). Am. J. Physiol. 187, 417-21(1956) Dec.

4231

EFFECTS OF LOW-LEVEL X-IRRADIATION OF OXYGEN CONSUMPTION OF BULLFROG ERYTHROCYTES. W. S. Martin, R. C. Grubbs, and M. A. Lessler (Ohio State Univ. Coll. of Medicine, Columbus). Am. J. Physiol. 187, 505-8 (1956) Dec.

4232

EFFECT OF LOCALIZED BRAIN STEM LESIONS AND SUPRADIAPHRAGMATIC VAGOTOMY ON X-IRRADIATION EMESIS IN THE MONKEY. Kenneth R. Brizzee (Univ. of Utah Coll. of Medicine, Salt Lake City). Am. J. Physiol. 187, 567-70(1956) Dec.

4233

THE TIME FUNCTION OF P^{32} INCORPORATION INTO DNA OF REGENERATANG LIVER: THE EFFECT OF IRRADIATION. Lola S. Kelly, J. Dorothy Hirsch, Genevieve Beach, and Wynne Palmer (Univ. of California, Berkeley). Cancer Research 17, 117-21(1957) Feb.

4234

THE EFFECTS OF HIGH-DOSAGE X-RAY ON THE MATURATION OF THE RAT OVUM AND THEIR MODIFICATION BY GONADOTROPINS. J. F. Spalding, J. M. Wellnitz, and W. H. Schweitzer (Los Alamos Scientific Lab., N. Mex.). Fertility and Sterility 8, No. 1, 80-8 (1957) Jan.-Feb.

4235

RADIATION PROCESSING OF FOODS. R. H. Wasserman (Oak Ridge Inst. of Nuclear Studies, Tenn.). J. Am. Dietet. Assoc. 33, 33-6(1957) Jan.

Recent advances in the processing of foods by exposure to ionizing radiations are reviewed. (C.H.)

4236

DESTRUCTION OF MICROÖRGANISMS IN WATER, SEWAGE, AND SEWAGE SLUDGE BY IONIZING RADIATIONS. Harry N. Lowe Jr., William J. Lacy, Bernard F. Surkiewicz, and Robert F. Jaeger. J. Am. Water Works Assoc. 48, 1663-72(1956) Nov.

4237

CHEMICAL AND BIOLOGICAL ALTERATIONS INDUCED BY IRRADIATION OF I^{131}-LABELED HUMAN SERUM ALBUMIN. Rosalyn S. Yalow and Solomon A. Berson (Veterans Administration Hospital, Bronx 68, N. Y.). J. Clin. Invest. 36, Part 1, 44-50(1957) Jan.

4238

THE PRIMARY HEMOLYSIN RESPONSE IN RABBITS FOLLOWING SHIELDING FROM X RAYS OF X IRRADIATION OF THE SPLEEN, APPENDIX, LIVER OR HIND LEGS. Dieter H. Süssdorf and Laurence R. Draper (The Univ. of Chicago, Ill.). J. Infectious Diseases 99, 129-42(1956) Sept.-Oct.

4239

EFFECT OF TOTAL BODY X-IRRADIATION ON THE RESPIRATION OF THE HOMOGENIZED DUODENAL MUCOSA OF THE RAT. S. Szonyi and W. Varteresz (Radiobiological Research Inst., Budapest). Nature 179, 51(1957) Jan. 5.

4240

INCORPORATION OF PHOSPHORUS-32 AND MUTAGENESIS DURING SPERMATOGENESIS IN DROSOPHILA. Per Oftedal and Jeanne Mossige (The Norwegian Radium Hospital, Olso). Nature 179, 104-5(1957) Jan. 12.

4241

INACCURACY OF ANAPHASE BRIDGES AS A MEASURE OF RADIATION-INDUCED NUCLEAR DAMAGE. Sheldon Wolff and H. E. Luippold (Oak Ridge National Lab., Tenn.). Nature 179, 208-9(1957) Jan. 26.

4242

THE INFLUENCE OF OXYGEN ON THE MUTAGENIC EFFECTS OF X-RAYS ON MAIZE ENDOSPERM LOCI. Calvin F. Konzak (Brookhaven National Lab., Upton, N. Y.). Radiation Research 6, 1-10(1957) Jan.

4243

INTERPRETATION OF RADIATION RESULTS BASED ON TARGET THEORY. Aadne Ore (Yale Univ., New Haven, Conn.). Radiation Research 6, 27-39(1957) Jan.

4244

STATE OF TISSUE ACETYLCHOLINESTERASE AS DETERMINED BY COBALT-60 GAMMA RADIATION INACTIVATION. Irving Serlin and George C. Cotzias (Brookhaven National Lab., Upton N. Y.). Radiation Research 6, 55-66(1957) Jan.

4245
ON THE PASSAGE OF HEAVY PARTICLES THROUGH TISSUE. W. S. Snyder and Jacob Neufeld (Oak Ridge National Lab., Tenn.). Radiation Research 6, 67–78(1957) Jan.

RADIATION HAZARDS AND PROTECTION

4246 AERE-C/R-286
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
REMOVAL OF RADIOACTIVE CONTAMINATION FROM VARIOUS SURFACES. E. S. Busk and K. D. B. Johnson. Dec. 1948. Decl. Nov. 26, 1956. 10p.

Results are given of a series of routine tests on the removal of β-active fission products from various paint and other surfaces. General conclusions are drawn from the results. (auth)

4247 AERE-HP/M-24
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE MAXIMUM PERMISSIBLE LEVEL OF IODINE-131 OVER GRASSLAND. R. C. Chadwick and A. C. Chamberlain. May 28, 1951. Decl. Dec. 20, 1956. 9p.

Experiments on the rate of deposition of airborne carrier-free I^{131} onto grass and onto filter papers are described. The velocity of deposition v_g is defined as the ratio of the rate of deposition per unit area to the volumetric concentration at a reference point (50 cm above ground). Mean values were calculated and it was deduced that a mean level of I^{131} over grassland that will lead to not more than a permissible level in the grass, is 0.7 $\mu\mu c/m^3$. (auth)

4248 KAPL-1689
Knolls Atomic Power Lab., Schenectady, N. Y.
HEALTH PHYSICS REPORT FOR JULY, AUGUST, SEPTEMBER 1956. 35p. Contract W-31-109-Eng-52. $0.30 (OTS).

Routine personnel, in-plant, and environmental radiation monitoring procedures engaged in during the period are summarized. (For preceding period see KAPL-1595.) (C.H.)

4249 USNRDL-TR-118
Naval Radiological Defense Lab., San Francisco.
RADIOTOXICITY RESULTING FROM EXPOSURE TO FALLOUT SIMULANT. II. THE METABOLISM OF AN INHALED AND INGESTED SIMULANT OF FALLOUT PRODUCED BY A LAND-BASED NUCLEAR DETONATION. S. H. Cohn, W. B. Lane, J. K. Gong, R. K. Fuller, and W. L. Milne. Jan. 11, 1957. 29p. Project NM 006-015.04.

The present study was designed to reproduce in the laboratory an acute exposure of mice to early fallout (2 days old) such as might result from a land-based nuclear detonation. Biological data were obtained on the uptake, distribution, and retention of the inhaled fallout simulant. Further, as a basis for comparing the effects of different types of simulants, the metabolic behavior of this dry-particle fallout simulant of limited solubility was compared to that of two previously studied fallout simulants; an ionic liquid aerosol and a mud-slurry aerosol. The simulant was also administered by gavage to provide data on uptake of fallout by ingestion as compared with inhalation. From these data, an evaluation was made of the radiation dose to individual tissues from inhaled fallout as compared to the concomitant external radiation dose that the animals would receive if exposed to the same airborne simulant. (auth)

4250 UWFL-45
Washington. Univ., Seattle. Applied Fisheries Lab.
PROGRAM OF THE APPLIED FISHERIES LABORATORY, UNIVERSITY OF WASHINGTON, FOR THE 1956 TEST SERIES AT BIKINI AND ENIWETOK ATOLLS, MARSHALL ISLANDS. Feb. 7, 1956. 27p. Contract AT(45-1)-540. $4.80(ph OTS); $2.70(mf OTS).

Proposals are presented for a radiobiological monitoring program and special studies to be carried out during the 1956 weapons tests at Bikini and Eniwetok Atolls, Marshall Islands. (C.H.)

4251
URANIUM MILL EMPLOYEES TESTED TO LEARN RADIUM BODY BURDEN. Arch. Ind. Health 15, 175-6(1957) Feb.

4252
HYPERPROTECTION AGAINST RADIATION BY COMBINING ADDITION OF CYSTEINE WITH LYOPHILIZATION. H. T. Epstein and D. Schardl (Brandeis Univ., Waltham, Mass.). Nature 179, 100(1957) Jan. 12.

4253
LATE EFFECTS OF GAMMA RADIATION ON MICE PROTECTED WITH CYSTEAMINE OR CYSTAMINE. D. J. Mewissen and Marshall Brucer (Oak Ridge Inst. Nuclear Studies, Tenn.). Nature 179, 201-2(1957) Jan. 26.

4254
THE EFFECT OF MERCAPTOETHYLAMINE ON SURVIVAL OF MICE IRRADIATED WITH COBALT 60. D. J. Mewissen (Oak Ridge Inst. of Nuclear Studies, Tenn.). Radiation Research 6, 85–97(1957) Jan.

4255
THE ARTIFICIAL KIDNEY AND ION-EXCHANGE RESINS AS POSSIBLE METHODS OF REMOVING RADIOELEMENTS FROM THE BODY. W. B. Looney, C. J. Maletskos, Marie Helmick, John Reardon, Jonathan Cohen, and Warren Guild (Massachusetts Inst. of Tech., Cambridge, Peter Bent Brigham Hospital, Boston, Mass., and Massachusetts General Hospital, Boston). Radiology 68, 255-6(1957) Feb.

4256
MAXIMUM PERMISSIBLE RADIATION EXPOSURES TO MAN. A PRELIMINARY STATEMENT OF THE NATIONAL COMMITTEE ON RADIATION PROTECTION AND MEASUREMENT. Radiology 68, 260-1(1957) Feb.

4357
STRONTIUM-90 IN MAN. J. Laurence Kulp, Walter R. Eckelmann, and Arthur R. Schulert (Columbia Univ., Palisades, N. Y.). Science 125, 219-25(1957) Feb. 8.

The world wide average Sr^{90} content of man was about 0.12 micromicrocurie per gram of calcium (1/10,000 of the maximum permissible concentration) in the fall of 1955. A few values as high as 10 times the average have been obtained. This value is in accord with the predicted value based on fallout measurements and fractionation through the soil-plant-milk-human chain. With the present burden of Sr^{90} this average level should rise to 1 to 2 micromicrocuries of Sr^{90} per gram of calcium by 1970. (auth)

RADIOTHERAPY

4258
TREATMENT OF HEMANGIOMAS WITH THE STRONTIUM-90 BETA-RAY APPLICATOR. David M. Sklaroff (Albert Einstein Medical Center, Philadelphia 41). Radiology 68, 87-9(1957) Jan.

The strontium-90 applicator has been used for the treat-

ment of hemangiomas of the "strawberry mark" variety. Its advantages over other methods are noted and 2 cases with excellent cosmetic results are described. (auth)

4259
A TECHNIC FOR PERMANENT IMPLANTATION OF RADIOISOTOPES. Ulrich K. Henschke (Memorial Center, New York). Radiology 68, 256(1957) Feb.

TOXICOLOGY STUDIES

4260 UR-469
Rochester, N. Y. Univ. Atomic Energy Project.
THE INDUSTRIAL HYGIENE AND TOXICOLOGY OF MERCURY. Charles J. Spiegl. Nov. 6, 1956. 26p. Contract W-7401-eng-49. $0.25(OTS).

TRACER APPLICATIONS

4261 UWFL-44
Washington. Univ., Seattle. Applied Fisheries Lab.
UPTAKE OF IODINE-131 BY THE RED ALGA ASPARAGOPSIS TAXIFORMIS. Ralph F. Palumbo. Nov. 20, 1955. 11p. Contract AT(45-1)-540. $3.30(ph OTS); $2.40(mf OTS).

4262
STUDIES OF INTERSTITIAL RADIOLUTETIUM (Lu^{177}) IN THE DOG. William M. Christopherson, Harold F. Berg, G. C. Kyker, and Marshall Brucer. Arch. Pathol. 62, 441-4(1956) Dec.

4263
TEMPORARY PRESERVATION OF CARCASSES OF SMALL LABORATORY ANIMALS CONTAINING RADIOACTIVE ISOTOPES. J. C. Boursnell and M. H. Gleeson-White (Univ. of Cambridge). Nature 179, 54(1957) Jan. 5.

CHEMISTRY

4264 AERE-M/R-2046
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
ON THE ION ADSORPTION PROPERTIES OF SYNTHETIC MAGNETITE. P. J. Anderson. Sept. 8, 1956. 29p.

An electrokinetic study has been made of magnetite dispersions in various electrolytes and ion adsorption isotherms calculated from the experimental results. It is shown that the magnetite surface possesses both cation and anion adsorption properties under appropriate conditions. The effects of pH upon the ζ-potential are interpreted in terms of a weak basic dissociation of surface groups. The significance of the results from the point of view of corrosion inhibition in water systems is discussed. (auth)

4265 CF-57-1-117
Oak Ridge National Lab., Tenn.
CATALYSTS FOR RECOMBINATION OF RADIOLYTIC GASES OVER THORIUM OXIDE SLURRIES. L. E. Morse. Jan. 29, 1957. 18p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

Catalysts for use in recombining the gases produced by the radiolytic decomposition of H_2O in ThO_2 slurries under neutron irradiation were investigated in out-of-pile tests using stoichiometric mixtures of H_2 and O_2. Most favorable results were obtained with a MoO_3 catalyst. Satisfactory rates also were attained with PdO and AgO. Copper, Ni, V and Cr compounds were less effective. Reactor irradiation of aqueous ThO_2-UO_3 slurries containing either MoO_3 or PdO demonstrated successful catalytic recombination of the radiolytic gases. (auth)

4266 NP-6204
Standard Oil Co. of Indiana, Whiting.
DEVELOPMENT OF THICKENERS FOR HIGH TEMPERATURE GREASES. Quarterly Progress Report No. 22 [for] October 10, 1956 to January 10, 1957. John C. Goossens. Jan. 1957. 9p. Contract AF33(038)-23687.

Monthly Progress Report No. 68 is incorporated with this report and will not be submitted separately.

Thickeners are being synthesized and evaluated for use in greases for temperatures in excess of 450°F and as high as 700°F. Organic compounds with melting points above 650°F which can be prepared easily are being prepared as potential thickeners. (W.L.H.)

4267 WAPD-A1W(PCh)-170
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
PURIFICATION OF WATER IN A HIGH TEMPERATURE, HIGH PRESSURE CARBON STEEL SYSTEM. C. F. Paulson. [Sept. 1956]. 78p. A1W Project. Contract NObs-67500.

Results of water purification in a high-temperature high-pressure carbon steel pump test loop are presented. The test covered cold and hot filtration by axial flow magnetite filters, and operation of ion exchangers in the H−OH and Li−OH forms. These tests demonstrated that filters and ion exchangers would operate successfully in a carbon steel system. (W.L.H.)

4268 AEC-tr-2823
THE ACIDITY FUNCTION OF THE SYSTEM $H_2SO_4-H_2O$ AT VARIOUS TEMPERATURES. A. N. Gelbshtein, G. G. Shcheglova, and M. N. Temkin. Translated from Zhur. Neorgan. Khim. 1, 506-15(1956). 13p.

The concentration and temperature dependence of the acidity function of H_2SO_4 is measured and discussed. (T.R.H.)

4269 AEC-tr-2824
THE RELATIONSHIP BETWEEN SOLUBILITY, COEFFICIENT OF ACTIVITY AND PROPERTIES OF PARTICLES CONSTITUTING A SOLUTION. M. I. Shakhparonov. Translated by V. Beak from Zhur. Fiz. Khim. 25, 1103-10 (1951). 12p.

An equation has been obtained which connects solubility with the coefficient of activity and with the physical values that characterize the properties of the particles making up a solution. The limits of applicability of this equation are discussed. (auth)

4270
KINETICS OF REACTIONS IN SOLUTION. Richard M. Noyes (Columbia Univ., New York and The Univ., Leeds, Eng.). Ann. Rev. Phys. Chem. 7, 185-206(1956).

The kinetics of homogeneous reactions in liquid phase is reviewed, including photochemistry, but excluding heterogeneous catalysis, reactions at electrodes, nucleation processes, and effects of ion-exchange resins and ionizing radiations. (T.R.H.)

4271
HIGH TEMPERATURE CHEMISTRY. Leo Brewer and Alan W. Searcy (Univ. of California, Berkeley). Ann. Rev. Phys. Chem. 7, 259-86(1956).

A review is presented of work reported in periodical literature on the chemistry of systems at temperatures high enough to change the chemical behavior appreciably. (T.R.H.)

4272
THERMOCHEMISTRY AND THERMODYNAMICS OF SUBSTANCES. Charles W. Beckett, Melville S. Green, and Harold W. Woolley (National Bureau of Standards, Wash

ington). Ann. Rev. Phys. Chem. 7, 287-310(1956).

Developments in the equation of state at very high temperatures and pressures are reviewed. The sub-topics are: Quantum Statistical Mechanics and the Thomas-Fermi Method; Static and Dynamic High Pressure Compression Measurements; Gases at High Temperature and Moderate Density. (T.R.H.)

4273

HIGH TEMPERATURE TECHNOLOGY. N. K. Hiester, F. A. Ferguson, and N. Fishman (Stanford Research Inst., Menlo Park, Calif.). Chem. Eng. 64, 237-52(1957) Mar.

A survey of the field of high temperature chemistry is given. Processes past and present are described and the future outlook as to methods and materials is discussed. (T.R.H.)

4274

SOME PHYSICAL PROPERTIES OF MOLTEN AND SUPERCOOLED GALLIUM TRICHLORIDE. N. N. Greenwood and K. Wade (The Univ., Nottingham, Eng.). J. Inorg. and Nuclear Chem. 3, 349-56(1957) Jan.

The viscosity of molten gallium trichloride has been measured both above and below the melting-point, and a small discontinuity in slope of the log $\eta - 1/T$ curve has been found near the melting-point despite the symmetrical and nonpolar nature of the gallium-trichloride dimer. The density and surface tension have also been determined over a range of temperature and the results used to calculate the parachor and related properties of the compound. (auth)

4275

IONIC AND COVALENT FORMS OF THE GALLIUM TRIHALIDES. N. N. Greenwood and I. J. Worrall (The Univ., Nottingham, Eng.). J. Inorg. and Nuclear Chem. 3, 357-64 (1957) Jan.

The electrical conductivity of crystalline gallium tribromide increases rapidly with rise in temperature up to maximum value of 16.5×10^{-6} ohm^{-1} cm^{-1} at 115°. About 3° below the m.p. (122.3°) the conductivity suddenly decreases, and this process continues as the compound melts, the conductivity passing through a minimum of 0.72×10^{-6} ohm^{-1} cm^{-1} some 2° above the m.p. This twenty-three-fold drop in conductivity at the melting-point is ascribed to a transformation from an ionic solid to a liquid which consists predominantly of dimeric Ga_2Br_6 molecules. Gallium trichloride (m.p. 77.75°) behaves similarly, the conductivity decreasing nine-fold from 15×10^{-6} to 1.7×10^{-6} on melting. Gallium tri-iodide has a somewhat higher conductivity and does not show the effect: near the m.p. (211.5°) the solid has a conductivity of 56×10^{-6}; the conductivity of the liquid is 118×10^{-6} ohm^{-1} cm^{-1}. Despite this increase in conductivity, it is shown that molten gallium tri-iodide, like the other two compounds, tends to favor the covalent form, the degree of ionization being much smaller than that in the solid state. The results are discussed and compared with earlier data on these and related compounds. (auth)

4276

THE PREPARATION OF RHODIUM(III) PERCHLORATE HEXAHYDRATE. Gilbert H. Ayres and John S. Forrester (The Univ. of Texas, Austin). J. Inorg. and Nuclear Chem. 3, 365-6(1957) Jan.

A stable Rh^{3+} perchlorate hexahydrate, $Rh(ClO_4).6H_2O$, has been prepared by reaction of perchloric acid with $RhCl_3$. The compound is crystalline and water-soluble. X-ray powder diffraction data are given. (auth)

4277

SOME ASPECTS OF THE PHYSICAL CHEMISTRY OF HYDROMETALLURGY. J. Halpern (Univ. of British Columbia, Vancouver, Can.). J. of Metals 9, 280-9(1957) Feb.

Some of the principles of physical chemistry underlying hydrometallurgical processes are discussed and an attempt is made to evaluate the various thermodynamic and kinetic factors which influence their operation. Recent research in this field is reviewed and a number of specific leaching and precipitation reactions are discussed in detail. The application of kinetic measurements to the elucidation of reaction mechanisms is emphasized. (auth)

4278

UREA DENATURATION OF IRRADIATED OVALBUMIN. Robert H. Maybury (Univ. of Redlands, Calif.). J. Phys. Chem. 61, 140-1(1957) Feb.

Irradiated ovalbumin, subjected to a light dosage of γ radiation, is denatured by urea, the kinetics of the denaturation being obtained from the polarimetrically measured optical rotations. A comparison between the rate of denaturation of the irradiated protein and the rate of denaturation of unirradiated material reveals the former to be significantly larger. An explanation of the observations is given in terms of the radiation rupture of bonds in hydrogen-bonded groups. (auth)

4279

PROCEEDINGS OF THE SYMPOSIUM ON "HIGH TEMPERATURE—A TOOL FOR THE FUTURE." Menlo Park, Calif., Stanford Research Inst., 1956. 226p. $5.00.

A survey of the field of high temperature research is presented. Methods of obtaining high temperatures, materials for containing high temperatures, and processes occurring at high temperatures are described and discussed. (T.R.H.)

ANALYTICAL PROCEDURES

4280 AERE-C/M-79

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ANALYTICAL CONTROL OF THE URANIUM 233 EXTRACTION PROCESS: A SURVEY OF AVAILABLE METHODS. L. Airey. Dec. 1950. Decl. Dec. 20, 1956. 4p.

4281 AERE-C/M-89(Del.)

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England].

... DUE TO BUTEX IN THE DETERMINATION OF URANIUM BY THE SPEKKER ABSORPTIOMETER METHOD. E. W. A. Pike. Oct. 17, 1950. Decl. with deletions Dec. 20, 1956. 2p.

4282 AERE-C/R-1287

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

COLORIMETRIC DETERMINATION OF PLUTONIUM IN MICROGRAM QUANTITIES. T. V. Healy and P. E. Brown. Nov. 1953. Decl. Nov. 26, 1956. 24p.

A method has been developed for the determination of Pu over the range 5 to 100 μg with an accuracy of $\pm$ 1% at the 100 μg level. The colored complex between Pu^{4+} and the commercial reagent Thoronol [1 – o-arsenophenyl-azo-2-naphthol-3-6-disulfonic acid] is measured on a Spekker Absorptiometer. This can be used to estimate the amounts of the Pu^{3+}, Pu^{4+}, and Pu^{6+} states present in a Pu sample. The thoronol complexes formed with Fe^{3+} and UO_2^{2+} ions have been examined at different acidities. Methods are suggested to remove or to minimize the effects due to most of the complexing cations such as Fe or anions such as F$^-$. (auth)

4283 AERE-C/R-2115

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE SPECTROGRAPHIC DETERMINATION OF Mo, Be, Fe, Cr AND Ni IN BISMUTH AND BISMUTH–URANIUM

ALLOYS. M. J. Owers and M. S. W. Webb. Dec. 19, 1956. 17p. (LMFT/P-12).

Bismuth metal or alloys are converted to oxide, Co and V incorporated as internal standards and 70 mgm. charges burnt to completion in cupped graphite electrodes. The resulting spectra are evaluated for Mo, Be, Fe, Cr, and Ni over the range 1 to 200 ppm by microphotometry, and, with the exception of Fe, sensitivities of 1 ppm or better are attained. At the 50 ppm level, coefficients of variation on single spectra vary from 12% in the case of Cr down to 6% for Mo and Ni. (auth)

4284 AERE-EL/M-96

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

AN IMPURITY ANALYSIS OF ALUMINIUM BY RADIOACTIVATION AND SCINTILLATION SPECTROMETRY. P. Iredale. Oct. 1956. 15p.

In this report the use of a γ-ray spectrometer in an impurity analysis of Al is described. The specimens of Al were irradiated in a flux of thermal neutrons and the identities of those impurities producing γ-rays when activated were established by measurements of γ-ray energy and of half life. In this way small amounts of impurities were detected while avoiding chemical separation. (auth)

4285 CCC-1024-TR-221

Oklahoma Agricultural and Mechanical Coll., Stillwater.

MICRODETERMINATION OF BORON IN ORGANOBORON COMPOUNDS. P. Arthur and W. P. Donahoo. Jan. 18, 1957. 22p. [For Callery Chemical Co. Contract NOa(s)-52-1024-c].

A procedure has been developed for the combustion of micro samples of organoboron compounds. The B_2O_6 formed by the combustion is quantitatively removed by refluxing water in the tube, and the resulting $B(OH)_3$ solution is titrated with NaOH, using mannitol as a complexing agent with an initial pH (before adding mannitol) of 5.4 and an end-point pH of 8.4. Best results are obtained when the B content of the solution is between 0.8 and 1.5 mg. (auth)

4286 HW-40544

Hanford Atomic Products Operation, Richland, Wash.

A TENTATIVE ANION EXCHANGE-PRECIPITATION PROCEDURE FOR THE DETERMINATION OF Cs^{137}. R. W. Perkins. Dec. 22, 1955. 4p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

4287 IGO-AM/W-64

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

THE GRAVIMETRIC DETERMINATION OF PLUTONIUM AS OXIDE AT 1250°C. J. L. Drummond. Dec. 18, 1956. 3p.

The solution of a pure Pu salt is fumed to dryness with H_2SO_4, and the $Pu(SO_4)_2$ is ignited at 1250°C to the stoichiometric dioxide, which is not hygroscopic. (auth)

4288 RME-4073

Division of Raw Materials, AEC.

THE ALKALI FLUORIDE AND CARBONATE BEAD TEST FOR URANIUM. Hans H. Adler. Apr. 1956. 13p. $0.15 (OTS).

The bead test is based upon the fluorescence color imparted by U fused in a suitable flux when irradiated with ultraviolet light. The procedure is elementary and can be carried out rapidly with a small amount of inexpensive equipment, which make it ideal for field purposes. (auth)

4289 WIN-62

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

ION EXCHANGE SPECTROPHOTOMETRIC DETERMINATION OF THORIUM. Oscar A. Nietzel, Bernard W. Wessling, and Michael A. DeSesa. Feb. 15, 1957. 16p. Contract AT(49-6)-924. $3.30(ph OTS); $2.40(mf OTS).

A sensitive method of analysis was needed for the determination of Th in connection with studies in this laboratory on the production of Th-free U concentrates. Two ion exchange procedures were developed for the separation of Th prior to spectrophotometric determination with thorin reagent. In the anion exchange procedure, possible cation interferences are removed by adsorption of their chloro complexes from 9M HCl onto Dowex-1 resin. The more specific cation exchange method consists of adsorption of cations from the sample onto Amberlite IR-120 resin, elution of most of the cations with 2M HCl, and recovery of the Th by elution with 3M H_2SO_4. The developed procedures were successfully used to determine Th in a variety of samples and should find application in the determination of low concentrations of Th in other complex materials. (auth)

4290 AEC-tr-2812

ASPECTS OF MINERAL METABOLISM IN THE SKELETON ANALYZED BY ABSORPTION OF ROENTGEN RAYS. R. Amprino. Translated from Arch. "Putti" II, 173-83 (1952). 27p.

4291

DETERMINATION OF PROTACTINIUM BY GAMMA SPECTROMETRY. Murrell L. Salutsky, Mary Lou Curtis, Kenneth Shaver, Andrew Elmlinger, and Robert A. Miller (Mound Lab., Miamisburg, Ohio). Anal. Chem. 29, 373-5 (1957) March.

Gamma pulse height analysis is used to determine less than 1 ppm concentrations of Pa in U residues with an accuracy within 5%. Magnitude of the 300-kev peak is a quantitative measure of Pa content. Corrections are made for interfering activities after precipitation on ThF_4 carrier. (auth)

4292

REMOTE CONTROL DETERMINATION OF CORROSION PRODUCTS AND ADDITIVES IN HOMOGENEOUS REACTOR FUEL. APPLICATION OF ION EXCHANGE. A. D. Horton, P. F. Thomason, and M. T. Kelley (Oak Ridge National Lab., Tenn.). Anal. Chem. 29, 388-91(1957) March.

Procedures are given for the separation and determination of corrosion products in UO_2SO_4 solution from a homogeneous reactor. The methods, suited for remote-control manipulations, use ion exchange resin separations and mostly polarographic determinations. Al, Ni, Fe, Co, Mn, Zr, Cu, and Cr are determined. (auth)

4293

USE OF ION EXCHANGE RESINS FOR DETERMINATION OF URANIUM IN ORES AND SOLUTIONS. Sallie Fisher and Robert Kunin (Rohm & Haas Co., Philadelphia). Anal. Chem. 29, 400-2(1957) March.

Uranium may be separated from interfering ions by adsorption of the UO_2SO_4 complex on a quaternary ammonium anion exchange resin. Iron^{3+} and vanadium^{5+} are not adsorbed if reduced with H_2SO_3. Uranium is eluted for analysis by 1M $HClO_4$. (auth)

4294

ESTIMATING TOTAL ABSOLUTE ACTIVITY OF SMALL RADIOACTIVE PRECIPITATES ON FILTER PAPER. Paul T. Wagner, Louis R. Pollack, and Clarence G. Donahoe, Jr. (Mare Island Naval Shipyard, Vallejo, Calif.). Anal. Chem. 29, 405-8(1957) March.

Total activity of radioactive precipitates on filter paper is estimated from the measured activities of both sides of the paper. Absorption coefficient for beta rays and thickness of the paper with precipitate must be known. Close-geometry conditions of counting must be used. (auth)

4295

RAPID ROUTINE METHOD FOR DETERMINATION OF URANIUM IN ORES. H. J. Seim, R. J. Morris, and D. W. Frew (Univ. of Nevada, Reno). Anal. Chem. 29, 443-6 (1957) March.

In a new, rapid, routine method for U in ores, UO_2SO_4 complex is adsorbed on anion exchange resin. After elution with 1M $HClO_4$, the U is determined colorimetrically by the $NaOH-H_2O_2$ method. As little as 0.01% uranium oxide is determined within ± 0.005%. (auth)

4296

SEPARATION AND DETERMINATION OF RADIOCERIUM BY LIQUID-LIQUID EXTRACTION. Gilbert W. Smith and Fletcher L. Moore (Oak Ridge National Lab., Tenn.). Anal. Chem. 29, 448-51(1957) March.

Extraction with 2-thenoyltrifluoroacetone-xylene offers a rapid purification technique for radioactive or inactive Ce^{4+} Fission product Ce can be estimated in carrier-free Ce tracer work. The carrier method offers a fast, safe, and simple determination of radio-cerium with yields of about 80% and precision within 2%. (auth)

4297

COLORIMETRIC DETERMINATION OF URANIUM BY DIBENZOYLMETHANE. P. Blanquet. Anal. Chim. Acta 16, 44-56(1957) Jan. (In French)

A colorimetric method for the determination of U by means of dibenzoylmethane has been studied and described. The complex is formed in aqueous pyridine in the presence of EDTA and tartaric acid; the optical density is measured at 415mμ. Beer's Law applies; the sensitivity amounts to 0.005% U in the mineral. The method involves only one filtration and can be used in the presence of various impurities including Mo, W, V, Ge, Th, F, and P. With a U content of more than 5% no single element disturbs the determination. With a content of less than 0.5% the absolute error amounts to more than 0.01% only in the presence of 1% Au, 2% Pt or 10% soluble Sr. The method described has been applied with completely satisfactory results to the analysis of pitchblende, antunite, thorianite, columbite, urano-thorianite, tantalite and carnotite containing from 0.05 to 25% U. (auth)

4298

DIRECT SPECTROPHOTOMETRIC DETERMINATION OF THORIUM WITH SPADNS. Gurupada Banerjee (Indian Association for the Cultivation of Science, Calcutta, India). Anal. Chim. Acta 16, 56-61(1957) Jan.

A direct spectrophotometric method is described for the determination of Th using (2-p-sulphophenylazo-1,8-dihydroxynaphthalene-3,6-disulphonic acid) as the reagent. The method is sensitive and quantities as small as 0.04 γ of Th can be estimated. Moderate amounts of U and rare earths do not interfere. The stoichiometric composition of the colored complex has been determined spectrophotometrically by the 'slope ratio method.' (auth)

4299

DIRECT SPECTROPHOTOMETRIC DETERMINATION OF ZIRCONIUM WITH SPADNS. Gurupada Banerjee (Indian Association for the Cultivation of Science, Calcutta, India). Anal. Chim. Acta 16, 62-6(1957) Jan.

A method has been developed for the spectrophotometric determination of microgram amounts of Zr using SPADNS as the color-forming agent. The method is sensitive and quantities as small as 0.07 γ of Zr can be estimated in 25 ml of final volume. A standard calibration curve has been prepared; it conforms to Beer's law. The stoichiometric composition of the colored complex has been determined spectrophotometrically by adopting the 'slope ratio method.' (auth)

4300

SPECTROPHOTOMETRIC DETERMINATION OF SILICON IN THORIUM OXIDE. Oscar Menis and D. L. Manning (Oak Ridge National Lab., Tenn.). Anal. Chim. Acta 16, 67-75(1957) Jan.

A method is described for the spectrophotometric determination of microgram quantities of Si in the presence of Th. Thorium oxide is dissolved by heating it at 70 to 80°C in 4M HNO_3 that contains 2 drops of HF. Under these conditions, no Si is lost through volatilization. The Si is estimated as the blue silicomolybdate complex. Under the conditions selected for development of color, a precipitate of thorium molybdate is obtained; the thorium molybdate is, however, dissolved without affecting the color of the complex by the addition of tartrate and adjusting the pH of the solution to 3.0. The lower limit of detection is about 5 ppm of Si. (auth)

4301

STUDIES ON COORDINATION COMPOUNDS. XVI. FORMATION CONSTANTS OF SOME METAL SALTS OF THE NITROSONAPHTHOLS. Clarence M. Callahan, W. Conard Fernelius, and B. P. Block (The Pennsylvania State Univ., University Park). Anal. Chim. Acta 16, 101-8 (1957) Feb.

Formation constants of various metal derivatives of 1-nitroso-2-naphthol and 2-nitroso-1-naphthol have been measured in 50 and 75 volume per cent dioxan. The anomalies of the nickel and cobalt compounds are considered and explanations offered. (auth)

4302

THE DETERMINATION OF URANIUM IN ALLOY SYSTEMS. G. W. C. Milner and J. W. Edwards (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Anal. Chim. Acta 16, 109-14(1957) Feb.

A procedure is described for the determination of the U content of metallurgical alloys containing this element as a minor constituent. The U is first separated from the sample solution by precipitation as uranyl ammonium phosphate in the presence of ethylenediamine-tetra-acetic acid. By this means the U is separated from many elements including Fe, Cr, Cu, Ni, V, Ce, Nd, and Bi. The uranyl ammonium phosphate precipitate is dissolved in HCl and the resulting solution is passed through a lead reductor. The UF_4 is titrated with a standard ceric sulfate solution, using ferroin as the indicator. This procedure has proved very suitable for the analysis of Bi–U binary alloys containing U in amounts up to approximately 20%. (auth)

4303

THORIUM COMPLEX OF 2,7-DINITROSO-1,8-DIHYDROXYNAPHTHALENE-3,6-DISULPHONIC ACID. III. COMPLEXOMETRIC DETERMINATION OF THORIUM WITH ETHYLENEDIAMINETETRAACETIC ACID. Sachindra Kumar Datta (Darjeeling Government Coll., India). Anal. Chim. Acta 16, 115-20(1957) Feb.

Thorium forms a pinkish-violet colored complex with dinitrosochromotropic acid, which has been used as an indicator in the titrimetric determination of Th with EDTA. The method is based on the fact that this colored complex is less stable than the Th-EDTA complex and breaks down after a bulk of Th has reacted with EDTA; this marks the end-point, which is the change from pinkish-violet to red. As little as 3.1 mg of Th present in 50 ml volume of solution may be accurately determined within a pH range from 2.2 to 3.5. The study of interferences revealed that quite a number of elements do not interfere; iron may be masked with ascorbic acid. Thorium may be determined by the same method, after separating it from many interfering ions by precipitating it with o-anisilic acid. (auth)

4304

THE THERMOLYSIS OF ZIRCONIUM PRECIPITATES. I. SALTS OF ORGANIC ACIDS. Wesley W. Wendlandt (Texas Technological Coll., Lubbock). Anal. Chim. Acta 16, 129-34(1957) Feb.

The thermal decomposition of the Zr salts of phthalic, phenoxyacetic, cinnamic, diphenic, p-bromonmandelic, benzilic, m-cresoxyacetic, salicylic and benzoic acids and 8-quinolinol were studied on the thermobalance. The precipitates exhibited varying degrees of stability with the first weight losses occurring in the temperature range of 45° to 160°. After decomposition through various intermediates, the oxide (ZrO_2) levels were obtained between 500° to 790°. (auth)

4305

CURRENT EFFICIENCY AND TITRATION EFFICIENCY IN COULOMETRIC TITRATIONS WITH ELECTROGENERATED CERIC ION DETERMINATION OF IODINE. James J. Lingane, C. H. Langford, and Fred C. Anson (Harvard Univ., Cambridge, Mass.). Anal. Chim. Acta 16, 165-74 (1957) Feb.

The current efficiency for the electrogeneration of ceric ion at a platinum anode falls considerably below 100% at both very small and at large current densities in both sulfuric and perchloric acid media. The maximal current efficiency is about 99.8%. Iodide ion can be titrated to iodine with an error of only about ±0.3%, even under conditions where the ceric ion generation, is obtained because iodine is oxidized to iodate ion at a potential slightly in advance of the potential at which cerous ion is oxidized. Since the electrogenerated iodate ion oxidized iodide ion only a minor fraction of the total quantity of electricity results from ceric ion generation, so the effect of its inefficient generation is greatly minimized. Satisfactory titrations of iodide ion to iodine can be performed without any cerous salt present, provided the generating current density is smaller than the limiting current density for oxidation of iodine to iodate ion. (auth)

4306

AMPEROMETRIC TITRATION OF CERIUM(III) WITH FERRICYANIDE. Guy William Leonard, Hubert J. Keily, and David N. Hume (Massachusetts Inst. of Tech., Cambridge, Mass.). Anal. Chim. Acta 16, 185-8(1957) Feb.

Milligram and larger quantities of Ce^{3+} may be determined accurately and precisely, even in the presence of large amounts of C^{4+} salts, by amperometric titration in 3 to 4M K_2CO_3 solution with potassium ferricyanide. A rotating Pt microelectrode held at the potential of the saturated calomel electrode is recommended. (auth)

4307

THE DETERMINATION OF TRACES OF BORON IN NICKEL. R. C. Chirnside, H. J. Cluley, and P. M. C. Proffitt (The General Electric Co., Wembley, Eng.). Analyst 82, 18-24(1957) Jan.

It was required to determine B at the level of a few ppm in Ni sheet used for the anodes of thermionic valves. In the method evolved, the sample is made the anode of a mercury-cathode electrolysis apparatus and dissolution of the sample and deposition of dissolved Ni into the Hg proceed simultaneously; the B in the electrolyte is then determined spectrophotometrically by the curcumin method. The electrolytic technique is advantageous in effecting solution of the sample and removal of the Ni by one operation and in minimizing the quantities of reagents introduced. Boron contents from 2 to 25 ppm have been found in the samples examined. By dissolving away only a surface portion of the samples, it has been possible to show that a concentration of B occurs at the surface of the nickel. (auth)

4308

DEVELOPMENTS IN THE MICRO VACUUM FUSION METHOD WITH PARTICULAR REFERENCE TO THE DETERMINATION OF OXYGEN, NITROGEN, AND HYDROGEN IN BERYLLIUM, TITANIUM, ZIRCONIUM, THORIUM, AND URANIUM. E. Booth, F. J. Bryant, and A. Parker (United Kingdom Atomic Energy Authority Research Group, Woolwich Outstation, Eng.). Analyst 82, 50-61(1957) Jan.

The application of the micro vacuum fusion technique to the determination of O_2, N_2, and H_2 in B, Be, Cu, Cr, Fe, Si, Ta, Th, Ti, U, and Zr has been examined. With sample weights in the range 10 to 100 mg, O_2 and H_2 have been determined with a precision and accuracy comparable with that usually obtained on the decigram to gram scale. Evidence is presented to support the view that the vacuum fusion determination of N_2 in Th, Ti, Zr, and U is often unreliable. (auth)

4309

A CONTINUOUS ETHER EXTRACTOR. K. J. Jensen and R. W. Bane (Argonne National Lab., Lemont, Ill.). Analyst 82, 67-70(1957) Jan.

An apparatus is described and a procedure given for ether extraction of U from HNO_3 solutions. Determinations of U in U–Al solutions were made which, for 18.7 mg U/ml solution, had a standard deviation of 0.22 mg. (T.R.H.)

4310

A STUDY OF MATRIX EFFECTS ON A GRAPHITE BASE SEMI-QUANTITATIVE PROCEDURE. E. L. Grove and J. A. Norris (Oak Ridge National Lab., Tenn.). Applied Spectroscopy 9, No. 2, 63-8(1955).

4311

ELECTROCHROMATOGRAPHY OF BORON. William H. Hill, Jean M. Merrill, and Betty J. Palm (Univ. of Pittsburgh). Arch. Ind. Health 15, 152-9(1957) Feb.

A new method for the determination of trace quantities of boron in biological and other materials has been presented. It is based on the migration of the borate ion to the anode of an electric field and its visualization as the red boron–turmeric complex, which is developed on the paper strip after ionophoresis. The method is exceedingly speedy, simple, and sensitive, as little as 0.01γ of boron being detectable by eyesight. (auth)

4312

DETERMINATION OF U AND Th BY γ SPECTROMETRY. Paul Keller. Compt. rend. 244, 762-5(1957) Feb. 4. (In French)

4313

A SPECTROPHOTOMETRIC STUDY OF THE THALLIUM (III) NITRATE COMPLEX. Eugene A. Burns and Roy A. Whiteker (Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc. 79, 866-70(1957) Feb. 20.

Spectrophotometric studies have been made at 22° of acid thallium(III) perchlorate solutions containing nitrate. The data have been interpreted in terms of a mononitratothallium(III) complex $K_1 = (TlNO_3^{++})/(Tl^{+++})(NO_3^-) = 8.3$ at $\mu = 0.567$, $(H^+) = 0.44$; 4.7 at $\mu = 1.15$, $(H^+) = 1.0$; 2.8 at $\mu = 2.00$, $(H^+) = 1.0$; 2.0 at $\mu = 3.00$, $(H^+) = 1.0$. The molar absorptivities for Tl^{+++}, $TlOH^{++}$ and $TlNO_3^{++}$ have been determined. A method has been developed for interpreting spectrophotometric data when significant hydrolysis as well as complex formation occurs. Data on the affinity of nitrate for various cations are tabulated. (auth)

4314

ELECTRODEPOSITION OF URANIUM AT THE MICROGRAM LEVEL. Charles L. Rulfs, Anil K. De, and Philip J. Elving (Univ. of Michigan, Ann Arbor). J. Electrochem. Soc. 104, 80-3(1957) Feb.

The recovery of microgram and submicrogram quantities of U by electroplating has been studied, using radioactive U^{233} as a tracer with and without the presence of microgram quantities of natural U as carrier. Optimum results were obtained in an ammonium oxalate medium with electrolysis at 80 to 85°C being performed first in acidic solution and then in alkaline solution. A small Pt disk which fitted into a flow counter was used as cathode, and a Pt spiral served as anode. With 20 μg of U carrier present and a volume of 25 ml, an average recovery, based on alpha counting, of 94 ± 3% was obtained for amounts of U^{233} ranging from 0.03 to 0.13 μg. (auth)

4315

NEUTRON ACTIVATION ANALYSIS OF TISSUE: MEASUREMENTS OF SODIUM, POTASSIUM, AND PHOSPHORUS IN MUSCLE. Leonard Reiffel and C. A. Stone. J. Lab. Clin. Med. 49, 286-91(1957) Feb.

The suitability of neutron activation analysis methods to the determination of Na, K, and P in milligram or submilligram samples of tissue has been established. The method is nondestructive in an elemental chemical sense and is accurate to approximately 5%. The required equipment, which is exceedingly simple, may be found in any laboratory equipped for tracer studies. The nuclear parameters and induced activity levels are such that mail service to a reactor will suffice for irradiation. (auth)

Refer also to abstracts 4333, 4441, and 4352.

ATOMIC WEIGHTS AND PERIODIC SYSTEMS

4316

ATOMIC WEIGHTS COMPUTED FROM PHYSICAL MEASUREMENTS. A. H. Wapstra. J. Inorg. and Nuclear Chem. 3, 329-32(1957) Jan.

Chemical atomic weights are calculated from isotopic abundance ratios and earlier computations of isotopic masses. (auth)

FLUORINE AND FLUORINE COMPOUNDS

4317 AERE-C/M-237

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE HYDROLYSIS OF THORIUM FLUORIDE. B. A. J. Lister and P. M. Bartlett. Feb. 1955. Decl. Dec. 20, 1956. 7p.

The hydrolysis of ThF_4 of varied particle size has been studied. It has been shown that for samples of surface area less than $1 m^2/g$, hydrolysis is not measurable after two hours below a temperature of 250°C. For ThF_4 of very small particle size (ca $20 m^2/g$ = 0.05 μ particle diameter) hydrolysis appears to start at a temperature of about 180°C. (auth)

4318 HW-47813

Hanford Atomic Products Operation, Richland, Wash.

LIQUID-VAPOR EQUILIBRIUM IN THE SYSTEM NITRIC ACID–WATER–TRACE FLUORIDE. Robert Lee Moore. Jan. 14, 1957. 15p. Contract W-31-109-Eng-52. $0.20 (OTS).

The distribution of trace fluoride between liquid and vapor was determined as a function of HNO_3 concentration, both at atmospheric pressure and at a reduced pressure of 100 mm Hg absolute, employing an Othmer-type equilibrium still constructed of stainless steel. All measurements were made at the boiling point of the solutions employed. The logarithm of the fluoride distribution coefficient was found to be roughly linear in the concentration of HNO_3 in the liquid phase and increased with the latter. The behavior at 100 mm Hg was almost identical to that at atmospheric pressure. (auth)

4319

THERMODYNAMIC FUNCTIONS OF SOME SIMPLE FLUORINE COMPOUNDS. Robert L. Potter (Bell Aircraft Corp., Buffalo, N. Y.). J. Chem. Phys. 26, 394-7(1957) Feb.

The thermodynamic functions of F(g), F_2(g), H^1F(g), D^2F(g), and the naturally occurring isotopic mixture of H^1F(g) and D^2F(g) have been calculated for these substances in the ideal gas state from 298.16°K to 5000°K by standard methods of statistical mechanics using available spectroscopic data. (auth)

4320

ROTATIONAL ANALYSIS OF BANDS OF THE $A^3\Pi_0^+$, $B^3\Pi_1 - X^1\Sigma^+$ SYSTEMS OF GALLIUM MONOFLUORIDE. R. F. Barrow and P. G. Dodsworth (Univ. of Oxford) and P. B. Zeeman (Univ. of Stellenbosch). Proc. Phys. Soc. (London) A70, 34-40(1957) Jan.

Rotational analyses of the 0, 0 band of the A–X system and of the 0, 0 and 0, 1 bands of the B–X system, for both molecules $Ga^{69}F$ and $Ga^{71}F$, have been made. The internuclear distance r_e'' in the ground state is 1·775 A; the energy of dissociation D_0'' (for $Ga^{69}F$) is found to be 143·$_3$ kcal $mole^{-1}$. (auth)

GRAPHITE

4321 AERE-Inf/Bib-109

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PURIFICATION OF GRAPHITE. P. M. Harris. Oct. 1956. 8p.

A bibliography on methods of purifying graphite is presented. The sources consulted are Chemical Abstracts, Nuclear Science Abstracts, Carbon Abstracts, and Proceedings of International Conference on Peaceful Uses of Atomic Energy, Geneva, August, 1955. (T.R.H.)

4322 AERE-Lib/Trans-689

REPORT ON RECENT INVESTIGATIONS ON GRAPHITE. Richard Arnold. Translated by F. Hudswell from Z. angew. Phys. 7, 453-60(1955). 18p.

Investigations reported in periodical literature on graphite are collated and the results compared. The crystal structure, electrical behavior, thermal properties, mechanical properties, chemical properties, and uses are discussed. (T.R.H.)

4323

EFFECT OF IRRADIATION ON THE LOW-TEMPERATURE SPECIFIC HEAT OF GRAPHITE. W. DeSorbo and W. W. Tyler (General Electric Research Lab., Schenectady, N. Y.). J. Chem. Phys. 26, 244-7(1957) Feb.

The specific heat of heavily irradiated Acheson-type graphite has been measured from 13° to 300°K. Throughout this temperature range, the specific heat of the irradiated graphite is appreciably larger than that of unirradiated graphite of similar type. This difference is explained by assuming that interplanar atoms or clusters of atoms, give rise to modes of low energy which contribute to the specific heat at lower temperatures than do the normal lattice modes. The entropy of the irradiated sample at 298.16°K is 1.492 ± 0.009 cal/g-atom deg compared with 1.372 ± 0.005 cal/g-atom deg for the unirradiated graphite. (auth)

Refer also to abstract 4699.

LABORATORIES AND EQUIPMENT

4324 AERE-GP/M-189

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE 1441A OXYGEN LEAK DETECTOR. R. S. Barton. Jan. 1956. 13p.

An auxiliary power pack, designed for use in conjunction with the 1075 ionization gage control unit, has been developed for the purpose of rapidly converting an ionization gage, used in a vacuum system for pressure measurements, into a diode for leak detection using O_2 as the probe gas. Entrance of the gas into the vacuum envelope leads to a decay of electron emission from the hot cathode of the diode and this is observed on a meter suitably positioned in the gage circuit. A description is given of experiments made to obtain the information necessary for the design of the above mentioned pack followed by a brief description of the type finally built for stores issue. (auth)

4325 AERE-Inf/Bib-58

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME REFERENCES TO THE CONSTRUCTION OF HOT LABORATORIES, THEIR FITTINGS, ETC. Jan. 18, 1950. Decl. Dec. 20, 1956. 4p.

4326 DP-186

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

RADIATION CONTROL AT THE SAVANNAH RIVER LABORATORY. Gordon M. Nichols. Nov. 1956. 15p. Contract AT(07-2)-1. $0.20(OTS).

A general discussion of the philosophy, organization, and functions of the Radiation Service organization of the Savannah River Laboratory is presented, together with a brief summary of operations to January 1956. (auth)

4327 ORNL-2238

Oak Ridge National Lab., Tenn.

TRITIUM HANDLING SYSTEM. B. J. Massey. Feb. 21, 1957. 6p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

An apparatus for storing and delivering tritium is described. (T.R.H.)

4328 UCRL-3635

California. Univ., Berkeley. Radiation Lab.

OFF-GAS TREATMENT IN BERKELEY ENCLOSURES. M. D. Thaxter, H. P. Cantelow, and C. Burk. Jan. 7, 1957. 16p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

Developments at UCRL in off-gas treatment are reviewed. A multiple-purpose gas scrubber and a total capture system for slug-dissolver off gas are described. (T.R.H.)

4329 UR-309

Rochester, N. Y. Univ. Atomic Energy Project.

A UNIT FOR EXPOSING ANIMALS TO RADIOACTIVE DUSTS. Aser Rothetein and Alastair Hayes. Dec. 14, 1956. 48p. Contract W-7401-Eng-49. $7.80(ph OTS); $3.30(mf OTS).

An exposure chamber has been designed for studying the inhalation toxicity of alpha emitting dusts. It consists of two modified dry boxes. The first serves as a living quarters for the experimental animals. The second, contains the exposure chamber and associated operating and control equipment. The unit is designed so that all operations including animal handling, inhalation exposure, washing of cages and exposure chamber can be carried out in a closed system under controlled air gradients. Thus the danger of radioactive contamination of the laboratory is minimized. Operating characteristics of the system are presented. (auth)

4330

A THERMAL-GRADIENT QUENCHING FURNACE FOR PREPARATION OF FUSED SALT SAMPLES FOR PHASE ANALYSIS. P. A. Tucker and E. F. Joy (Monsanto Chemical Co., Miamisburg, Ohio). Am. Ceram. Soc. Bull. 36, 52-4(1957) Feb.

A thermal-gradient quenching furnace is described which provides a convenient method of preparation of fused salt samples for phase analysis. In a single quenching operation, a sample of known composition can be studied over a wide temperature range. Details for the preparation and loading of sample tubes are described. Operation of the equipment within specified limits enables establishing thermal gradients over the length of the sample as small as 16°C or as large as 200°C. Sectioning the quenched sample tube provides 32 samples for study over the entire temperature range. (auth)

MOLECULAR STRUCTURE

4331

EQUIVALENT ORBITAL BOND MOMENTS: APPLICATIONS TO CARBON DIOXIDE AND WATER. Walter C. Hamilton (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 26, 345-51(1957) Feb.

Self-consistent field molecular orbitals for CO_2, H_2O and the B_2H_4 skeleton of diborane have been transformed into equivalent orbital representations, and bond moments have been defined as the dipole moments of the corresponding equivalent orbitals. If a maximum localization criterion is imposed and if hybrid moments (atomic dipole terms) on central atoms are omitted, one obtains moments of $2.6D(C^+O^-)$ in CO_2, $1.4D(O^-H^+)$ in water, and $2.03D(B_2^+H^-)$ in a line perpendicular to the B–B bond in diborane. The treatment of water does not seem to allow a separation of well-localized bond and lone-pair moments with the proper directional properties. The bond moment of C–H in methane, according to these criteria, is $0.6D(C^-H^+)$. It is concluded that the method is a valid approach to the problem of nonempirical calculation of bond moments in polyatomic molecules. (auth)

RADIATION CHEMISTRY

4332 AF-SAM-57-36

School of Aviation Medicine, Randolph AFB, Texas.

PROTECTION OF PYRIMIDINES BY SULFUR COMPOUNDS FROM DESTRUCTION BY X-IRRADIATION. Robert M. Dowben. Sept. 1956. 49.

The destruction of several pyrimidines and their corresponding nucleosides and nucleotides in aqueous solutions by irradiation with x-rays and gamma rays has been studied. The bases uracil and cytosine and their corresponding nucleosides and nucleotides were found to be particularly sensitive to irradiation, and to destruction by Fenton's reagent as well. Irradiation of solutions at room temperature and at -60°C and at several concentrations has made possible an evaluation of direct and indirect effects. The addition of the sulfhydryl compounds glutathione, cysteine, cysteamine, β-aminoethylisothiouronium dibromide and thiourea to the pyrimidine solutions results in protection from destruction upon irradiation. The protective effect of the sulfhydryl compounds in this system has been compared with their relative protective action in the whole animal. (auth)

4333

REPRODUCIBILITY OF RADIOACTIVE SAMPLE PREPARATION TECHNIQUES. George K. Schweitzer and James S. Eldridge (Univ. of Tennessee, Knoxville and Oak Ridge Inst. of Nuclear Studies, Tenn.). Anal. Chim. Acta 16, 189-93(1957) Feb.

The reproducibility of samples prepared for the determination of radioactivity has been investigated for a low-energy beta-emitting nuclide, a high-energy beta-emitting nuclide, and a gamma-emitting nuclide. Variables studied, in addition to the nature of the nuclide, were: the total solid concentration in solution, the nature of the sample mount, the pH value of the solution, the use of auxiliary porous media (paper), and the effect of a wetting agent. High total solid concentration had a great effect on the reproducibility of measurements made with the low energy beta-emitter, and a less pronounced effect on measurements made with the high energy beta-emitter. The effect of total solids was negligible for measurements of the gamma-emitter using a single-channel scintillation spectrometer. Copper or aluminum planchets gave best reproducibility for the beta-emitting nuclides, whereas copper planchets or steel cups were best for the gamma-emitter. The effect of the other factors studied was negligible under conditions of this investigation. (auth)

4334

RADIATION CHEMISTRY. C. J. Hochanadel and S. C. Lind (Oak Ridge National Lab., Tenn.). Ann. Rev. Phys. Chem. 7, 83-106(1956).

Studies of reactions induced by absorption of high-energy radiation are reviewed with special emphasis on mechanisms. (T.R.H.)

4335

CHEMICAL SPECIES PRODUCED BY NEUTRON IRRADIATION OF PHOSPHORUS TRICHLORIDE. P. K. Conn and R. E. Hein (Kansas State Coll., Manhattan). J. Am. Chem. Soc. 79, 60-3(1957) Jan. 5.

The labeled chemical species produced by neutron irradiation of PCl_3 were separated after additions of carriers by distillation techniques. Analyses of PCl_3 samples, which had been irradiated both in the gaseous and liquid phase for time intervals varying from 3 weeks to 19 hours and at reactor temperatures varying from 140 to 30°, indicated 88% of the P^{32} was present in the mother molecule. The remaining P^{32} present in higher boiling fractions may have distilled over in part with the added carriers, $POCl_3$ and $PSCl_3$. About 30% of the S^{35} was found in $PSCl_3$ and a large percentage of the remainder was present as elemental sulfur. No visual decomposition of the compound was noted for any of the irradiation exposures. (auth)

4336

CHEMICAL STATE OF RADIO-IODINE IN NEUTRON-IRRADIATED PERIODATE AFTER THERMAL TREATMENT. A. H. W. Aten, Jr., G. K. Koch, G. A. Wesselink, and A. M. de Roos. J. Am. Chem. Soc. 79, 63-6(1957) Jan. 5.

The distribution of radioactive iodine over the iodide–iodine, iodate and periodate fractions is determined in neutron-irradiated potassium periodate. The main activity is found in the iodate fraction with minor contributions in the other fractions. If the activated solid is heated, the iodide–iodine activity disappears below 100°. Above this temperature most of the activity goes into the periodate fraction but part of it remains in the iodate fraction. (auth)

4337

AN ENHANCEMENT OF CATALYTIC ACTIVITY BY GAMMA RADIATION. Ellision H. Taylor and Harold W. Kohn (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 79, 252-3(1957) Jan. 5.

Evidence is presented for the production by γ-rays of a marked increase in catalytic activity of Al_2O_3. (W.L.H.)

4338

CHEMICAL EFFECTS OF NUCLEAR ACTIVATION OF BROMINE IN THE PROPYL BROMIDES. Robert H. Schuler and Charles E. McCauley (Brookhaven National Lab., Upton, N. Y. and St. Peter's College, Jersey City, N. J.). J. Am. Chem. Soc. 79, 821-5(1957) Feb. 20.

Very similar retentions have been observed for the bromine isotopes, Br^{80} and Br^{82}, in (n,γ) activation of solid as well as liquid n-propyl and isopropyl bromide. This lack of isotopic separation appears to be in agreement with previous work on the alkyl iodides where (n,γ) produced I^{128} and (n,2n) produced I^{126} were found to have comparable retentions. The retentions were also found to be the same for Br^{82} produced by capture of highly thermalized neutrons from a thermal column in the Brookhaven reactor and by capture of unmoderated cyclotron neutrons. In contrast to the similarity of yields in these other observations, 6-min. Br^{78} produced by (n,2n) activation of the propyl bromides is found to have a somewhat higher retention than Br^{82} produced simultaneously by (n,γ) activation. This difference occurs in both solid and liquid samples and in liquid samples containing small amounts of added bromine. It appears that the higher retention for the Br^{78} isotope may result from the increased fragmentation produced by the very much more energetic recoil atom. (auth)

4339

THE KINETICS AND CARBON-13 ISOTOPE EFFECT IN THE DECOMPOSITION OF SUBSTITUTED UREAS. Ellington M. Magee and Farrington Daniels (Univ. of Wisconsin, Madison). J. Am. Chem. Soc. 79, 829-32 (1957) Feb. 20.

The rate constants for the decomposition in propionic acid of urea, sym-dimethylurea, phenylurea, sym-diphenylurea and 3,3′-dimethylcarbanilide have been measured at various temperatures and the carbon-13 isotope effect has been determined for these reactions. All the reactions were first order except that of urea, which exhibited second-order kinetics with respect to the urea. The first-order activation energies and the isotope effects can be explained on the basis of resonance in the activated complex. (auth)

4340

CHEMICAL ACTION OF IONISING RADIATIONS IN SOLUTION. PART XVII. DEGRADATION OF DEOXYRIBONUCLEIC ACID IN AQUEOUS SOLUTION BY IRRADIATION WITH X-RAYS (200 kv). M. Daniels, G. Scholes, J. Weiss, and C. M. Wheeler (Univ. of Durham, Newcastle upon Tyne, 1). J. Chem. Soc. 226-34(1957) Jan.

4341

CHEMICAL ACTION OF IONISING RADIATIONS IN SOLUTION. PART XVIII. ACTION OF X-RAYS (200 kv) ON α- AND β-GLYCEROPHOSPHATE IN AQUEOUS SOLUTION. G. Scholes, W. Taylor, and J. Weiss (Univ. of Durham, Newcastle upon Tyne, 1). J. Chem. Soc. 235-46 (1957) Jan.

4342

CHEMICAL ACTION OF IONISING RADIATIONS IN SOLUTION. PART XIX. SOME ASPECTS OF THE REDUCTION OF METHYLENE-BLUE BY X-RAYS IN AQUEOUS SYSTEMS. E. Hayon, G. Scholes, and J. Weiss (Univ. of Durham, Newcastle upon Tyne, 1). J. Chem. Soc. 301-11 (1957) Jan.

4343

CHEMICAL EVIDENCE OF TRACK EFFECTS IN THE RADIOLYSIS OF LIQUIDS. Adolphe Chapiro (Laboratoire de Chimie Physique de la Faculté des Sciences de Paris, France). Radiation Research 6, 11–26(1957) Jan.

4344

RADIATION POLYMERIZATION OF LIQUIDS. Frank E. Hoecker and Ivan Watkins (Univ. of Kansas, Lawrence). Radiology 68, 257(1957) Feb.

RADIATION EFFECTS

4345 FPS-20

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

RADIATION STABILITY OF CAESIUM CHLORIDE AND CAESIUM SULPHATE. T. F. Williams. Sept. 24, 1954. Decl. Dec. 20, 1956. 2p.

4346

ACTION OF GAMMA RAYS ON POLYMERS IN THE SOLID STATE. III. IRRADIATION OF POLYVINYL CHLORIDE. Adolphe Chapiro. J. chim. phys. 53, 895-902(1956) Nov.–Dec. (In French)

A study was made of the action of ionizing radiation on polyvinyl chloride in the form of filaments and transparent films. If the irradiation is made in the presence of air, the polymer filaments are degraded while in vacuum a reticulation of the polymer is observed. The radiochemical yield of this reticulation is very small. The spectra of the irradiated films show characteristic absorption bands whose position is modified if the polymer includes stabilizers. The color and the absorption spectra of the irradiated polymer are different according to whether the irradiation is made in the presence of air or in vacuum. Towards the end of the irradiation a slow evolution of the coloration and spectrum with time was ascertained. An interpretation of these observations is proposed. (tr-auth)

4347

DIRECT AND INDIRECT ACTION OF IONIZING RADIATIONS ON AQUEOUS SOLUTIONS. I. STUDY OF THE DIRECT ACTION ON PERCHLORIC ACID. Maurice Cottin. J. chim. phys. 53, 903-16(1956) Nov.–Dec. (In French)

The chemical modifications induced in aqueous solutions by ionizing radiations are due either to a direct action in which the changed molecule is that which directly absorbs the energy or to an indirect action in which the molecule is changed by the action of the free radicals formed in the solvent. The direct action was studied by Co γ irradiation in concentrated solutions of perchloric acid or sodium perchlorate. The perchlorate ions are decomposed, as much in the absence of air, with the formation of chlorides and chlorates. The yields of these two products are proportional to the concentration of the perchloric solutions and independent of the nature of the physical state of the solution and of the presence of dissolved oxygen. A mechanism is proposed to explain the observed phenomena. The energy utilized to decompose a perchlorate ion is evaluated at about 25 ev. (tr-auth)

4348

DIRECT AND INDIRECT ACTIONS OF IONIZING RADIATIONS ON AQUEOUS SOLUTIONS. II. STUDY OF INDIRECT ACTION ON PHOSPHOROUS ACID. Maurice Cottin. J. chim phys. 53, 917-28(1956) Nov.–Dec. (In French)

The indirect action of 10-kev x rays, Co^{60} γ rays and Po α rays on dilute solutions of phosphorous acid and sodium phosphite was studied. The phosphorous ions were completely oxidized though a reduction of the phosphoric ions was not observed. The oxidation yield of the phosphorous ions in degassed solution and under the action of x and γ rays depends on the initial concentration and pH. The formation of hydrogen is always equivalent to that of the phosphate formed. In the presence of air the higher yields observed imply a chain mechanism of reaction: the observed yields allow one to determine that the energy used to decompose a water molecule by x and γ rays is about 27 ev at pH 4.3 and about 24 ev in 0.8N sulfuric acid. The α rays, in the absence of air, oxidize the phosphorous acid with a lower yield than in the case of x and γ rays. The production of oxygenated water in the dilute solutions is also observed, but the sum of the yields in oxygenated water and in phosphoric acid is constant. (tr-auth)

4349

CHEMICAL EFFECTS OF NUCLEAR RADIATIONS ON 8-HYDROXYQUINOLINE IN AQUEOUS SOLUTION. S. Kertes, M. Lederer and M. Lefort. J. chim. phys. 53, 959-62(1956) Nov.–Dec. (In French)

A study was made of the effect of γ radiation on aqueous 0.1N HCl solutions of 8-hydroxyquinoline in order to determine whether this compound remains useful for the analysis and separation of fission products or other highly radioactive elements. The 8-hydroxyquinoline in aqueous HCl solution is extremely radioresistant and can be used in the presence of tens of curies of radioelements. Among the radiolysis products isolated by paper chromatography, some of them conserve the complex properties and have the neighboring structure of the exit oxine. For the others, formed in the course of a prolonged degradation, the cycle containing the nitrogen has been destroyed, but a benzene nucleus remains. (tr-auth)

4350

γ-IRRADIATION OF POLYMETHYL METHACRYLATE AND POLYSTYRENE. L. A. Wall and D. W. Brown (National Bureau of Standards, Washington). J. Phys. Chem. 61, 129-36(1957) Feb.

The number of scissions produced in polymethyl methacrylate for a given dose of γ irradiation is decreased measurably by the presence of air, small amounts of benzene, and by lowering the temperature to −196°. Irradiation in air produced labile structures in the polymer, probably peroxides, which decompose and cause further scissions. The decomposition of these structures is accelerated by traces of t-butylcatechol, hydroquinone and dimethylaniline. The cross-linking reaction in polystyrene caused by γ irradiation is also decreased when temperatures are lowered to −196°. Studies of partially deuterated styrenes show little correlation between cross-link formation and site of deuteration. This observation, plus the fact that cross-links exceed the number of hydrogen molecules produced, suggests that the phenyl ring is involved in cross-linking. Comparison of the results with deuterated polystyrene and deuterated polyethylene indicates a difference between the two materials in the mechanisms of irradiation-induced processes. (auth)

4351

MELTING BEHAVIOR OF IRRADIATED POLYETHYLENE. Malcolm Dole and W. H. Howard (Northwestern Univ., Evanston, Ill.). J. Phys. Chem. 61, 137-9(1957) Feb.

The specific heat of a sample of polyethylene exposed to 50 megarep of γ radiation as well as one exposed to approximately 336 megarep of pile radiations has been measured from −20 to 140°. In the case of the 50 megarep sample a slight depression of the maximum melting temperature of about 1.5° was observed, although no flow of the polyethylene occurred above this temperature. In all other respects the specific heat of this sample was identical with that of unirradiated polyethylene. In the case of the pile irradiated sample, the crystallinity decreased 5.7%. No depression of the maximum melting point could be observed, probably because of a change in the character of the melting. The G-value for hydrogen evolution was estimated to be 3.75. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

4352 IGRL-T/C-38

MOLAR EXTINCTION-COEFFICIENTS OF THE RARE-EARTHS AND THEIR ANALYTICAL USE. L. Holleck and L. Hartinger. Translated by J. Standring from Angew. Chem. 67, 648-51(1955). 9p.

The absorption spectra of the chlorides of Pr, Nd, Sm, Eu, Gd, Th, Dy, Ho, Er, Tm, and Yb were plotted on a spectrophotometer and molar extinction coefficients determined, some for the first time. In particular, their applicability for analytical purposes is illustrated. (auth)

4353

CATALYTIC PROPERTIES OF RARE EARTHS. V. I. Komarewsky (Illinois Inst. of Tech., Chicago). Ind. Eng. Chem. 49, 264-5(1957) Feb.

Because they are by-products of atomic piles and of titanium production, rare earth elements are becoming increasingly available materials. Their physical and chemical properties, characterized by changing valency and paramagnetism, make them promising as catalysts. The action of neodymium and samarium oxides on alcohols and hydrocarbons is reported. Both oxides exhibit dehydrogenation activity. (auth)

SEPARATION PROCEDURES

4354 AECU-3396

Babcock and Wilcox Co. Research Center, Alliance, Ohio.

[DEVELOPMENT AND TESTING OF A STEAM–WATER SEPARATOR FOR A HOMOGENEOUS BOILING WATER REACTOR UTILIZING NATURAL CIRCULATION.] Final Report. W. H. Moyer. June 29, 1955. 57p. For [Oak Ridge National Lab.]. Contract W-7405-eng-26, Subcontract 534. (BW-5316). $9.30(ph OTS); $3.60(mf OTS).

Progress is reported in the development and testing of a steam–water separator for a homogeneous boiling water reactor utilizing natural circulation. Results are presented from a study of pressure drop in conventional separators, a study of capacity in a conventional separator, and tests of numerous separator designs. Recommendations are made for a separator design. (C.H.)

4355 AECU-3414

Babcock and Wilcox Co. Research Center, Alliance, Ohio.

SEPARATOR LITERATURE SURVEY. W. H. Moyer. July 29, 1954. 58p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 534. (BW-5315). $9.30(ph OTS); $3.60(mf OTS).

The results are given of a literature survey on all types of cyclone separators. Capacity as a function of void fraction and pressure drop is the specific subject of the search. (T.R.H.)

4356 AERE-C/M-31(Del.)

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.]

SOME HEAT, PARTITION AND DENSITY DATA FOR THE SYSTEM URANYL NITRATE–AMMONIUM NITRATE–HEXONE. R. Jenkins and H. A. C. McKay. Sept. 1949. Decl. with deletions Dec. 20, 1956. 8p.

4357 AERE-C/M-186

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE REACTION OF FISSION PRODUCT IODINE WITH SOLVENTS. N. J. Keen and K. Alcock. Oct. 1953. Decl. Nov. 26, 1956. 10p.

Iodine combines to a small extent with butex, tributyl phosphate, and kerosene, or more probably, with some impurities contained in the solvents. The rate of extraction of I_2 from these solvents has been determined and it has been shown that cold NaOH will remove all the free I_2 in 5 minutes, but the residual combined I_2 is not extracted even under much more drastic conditions. (auth)

4358 AERE-C/R-1113

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SEPARATION AND PURIFICATION OF MILLIGRAM QUANTITIES OF AMERICIUM. P. D. Herniman. Jan. 26, 1953. Decl. Nov. 26, 1956. 8p.

A method is described for the separation and purification of Am from solutions containing relatively large amounts of Fe, U, and Pu. (auth)

4359 AERE-C/R-1212

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME FISSION PRODUCT PARTITION DATA. H. A. C. McKay, K. Alcock, and D. Scargill. 1953. Decl. Dec. 20, 1956. 5p.

Some solvent partition data for Ce and Y in butex–H_2O–HNO_3, and for Zr, Ce, and Pu in butex and TBP are given. (T.R.H.)

4360 AERE-C/R-1896

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SEPARATION OF HEAVY METALS WITH ACID ALKYL PHOSPHATE AND PHOSPHONATE RESINS. J. Kennedy, R. V. Davies, and B. K. Robinson. Mar. 3, 1956. 6p.

Di-allyl phosphate resin in the H^+ and Na^+ form in conjunction with inorganic acids and di-sodium ethylenediamine tetraacetate as eluting agents has been successfully employed in the separation of UO_2^{2+} from alkaline earths, divalent transitional, trivalent Fe and lanthanide elements. Separation from tetravalent cations such as Zr and Th was not complete. (auth)

4361 CF-56-7-95

Oak Ridge National Lab., Tenn.

RAW MATERIALS PROCESS TESTING. Engineering Section Progress Report [for] April 1956. A. D. Ryon and K. O. Johnsson. July 17, 1956. 16p. Contract [W-7405-eng-26].

This is a continuation of studies reported in ORNL-2112. $0.25(OTS).

Runs were performed on processing low Mo leach liquors with and without secondary stripping using the Amex Process. Work on the solvent extraction of U is also included. (For preceding period see CF-56-8-30.) (W.L.H.)

4362 IDO-14392

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

SEPARATION OF NITRATE AND ALUMINUM FROM RADIOACTIVE CHEMICAL WASTES. John B. Huff. Nov. 1, 1956. 19p. Contract AT(10-1)-205. $0.20(OTS).

A laboratory process for fractionating Al and NO_3^- from fission products in solution is described. Nitrates are removed by reduction to NO_2^- with C. Excess C absorbs the residues to form a porous sinter. The sinter is chlorinated at elevated temperatures to expel Al as the volatile Cl^-. Burning the C residue from chlorination yields an ash of crude fission product compounds. Some plant design problems are discussed. (auth)

4363 NYO-7784

Aeroprojects, Inc., West Chester, Penna.

INVESTIGATIONS TO DETERMINE THE FEASIBILITY OF ULTRASONIC LIQUID-LIQUID EXTRACTION. Ninth

Progress Report Covering Period From December 1, 1956 to January 31, 1957. Jan. 1957. 11p. Contract AT(30-1)-1798. $1.80(ph OTS); $1.80(mf OTS).

A two-stage ultrasonic mixer-settler system was tested in the extraction of a $UO_2(NO_3)_2-Al(NO_3)_3-HNO_3$ feed solution with 6% TBP in kerosene. Over-all extraction efficiency was 85 to 88%, while a corresponding non-ultrasonic control run showed only 48% efficiency. (auth)

4364 RMO-2938

Virginia-Carolina Chemical Corp., Richmond.

ENGINEERING AND ECONOMIC EVALUATION OF LEACHED ZONE PROCESSES. R. H. Kean. Apr. 15, 1953. Decl. Nov. 17, 1955. 81p. Project 882. $13.80 (ph OTS); $4.80(mf OTS).

Six proposed methods of processing leached zone ore and a pre-engineering evaluation of the processes with respect to their relative technological and economic desirability for the purpose of guiding future research and development are summarized. The proposed methods are: single product and digestion, H_2SO_4 and HNO_3 digestion, ammonium sulfate fusion process, alkaline extraction process—calcium phosphate product, and alkaline extraction process—sodium phosphate product. (J.E.D.)

4365 WIN-28

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

SOLVENT EXTRACTION OF URANIUM FROM SULFURIC ACID ELUATES. Henry G. Petrow, Kenneth P. Quinlan, Harold N. Marenburg, and John C. Apidianakis. Mar. 29, 1956. Changed from OFFICIAL USE ONLY Jan. 25, 1957. 17p. Contract AT(49-6)-924. $3.30(ph OTS); $2.40(mf OTS).

A process for the elution of U from loaded Amberlite XE-123 resin with H_2SO_4, and the subsequent recovery of the U from the pregnant eluate by solvent extraction has been devised. The process eliminates many of the difficulties accompanying both NO_3^- and Cl^- elution, and in an RIP system, indicates a lower chemical cost than with either NO_3^- or Cl^- elution. (auth)

4366 WIN-49

National Lead Co. Raw Materials Development Lab., Winchester, Mass.

LABORATORY INVESTIGATION OF MIDNIGHT MINES ORE. E. S. Porter, E. T. Hollis, and H. I. Viklund. Dec. 14, 1956. 24p. Contract AT(49-6)-924. $4.80(ph OTS); $2.70(mf OTS).

Laboratory amenability testing was carried out on two samples of ore from the Midnight Mines, Spokane, Washington. Acid leaching, filtration and thickening of neutral and acid pulps, ion exchange of acid liquors, and carbonate leaching are discussed. Results of ion exchange testing of an acid leach liquor from the Grand Junction Pilot Plant are also reported. (auth)

4367 WIN-50

National Lead Co. Raw Materials Development Lab., Winchester, Mass.

LABORATORY INVESTIGATION OF MINERAL JOE ORE. E. S. Porter and H. I. Viklund. Jan. 28, 1957. 26p. Contract AT(49-6)-924. $4.80(ph OTS); $2.70(mf OTS).

The results of laboratory testing of two samples of ore from the Mineral Joe Mine in the Jo Dandy Area are presented. A major part of the discussion concerns acid leaching, solid-liquid separation of acid leached pulps and ion exchange of the resulting solutions. Data are also presented on the U extraction and reagent consumption by leaching with carbonate solutions. The results of one test on the recovery of V after extracting the U are reported. (auth)

4368

SEPARATION OF URANIUM FROM VANADIUM BY ION EXCHANGE: WITH SPECIAL REFERENCE TO THE DETERMINATION OF SMALL AMOUNTS OF URANIUM. T. K. S. Murthy (Atomic Energy Establishment, Bombay, India). Anal. Chim. Acta 16, 25-8(1957) Jan.

An ion exchange method has been worked out for the separation of milligram quantities of U from large amounts of V. A solution containing V and U and excess Na_2CO_3 is passed through a column filled with an anion exchanger in the chloride form. All the U and part of the V are adsorbed by the resin. The adsorbed V is first eluted with 10% Na_2CO_3 solution leaving U in the column. U is then eluted with NaCl and estimated colorimetrically. (auth)

4369

PREPARATION OF CARRIER-FREE YTTRIUM-90 BY PAPER CHROMATOGRAPHY. Toshiyasu Kiba, Shigeru Ohashi, and Satoshi Tada. Bull. Chem. Soc. Japan 29, 745-8(1956) Sept.

Carrier-free, 99.9% Y^{90} can be separated rapidly and simply from Sr^{90} by paper chromatography. The solvent used was C_2H_5OH with NH_4SCN. (auth)

4370

THE MUTUAL SEPARATION OF THORIUM, PROTOACTINIUM, AND URANIUM BY TRIBUTYL PHOSPHATE EXTRACTION FROM HYDROCHLORIC ACID. D. F. Peppard, G. W. Mason, and M. V. Gergel (Argonne National Lab., Lemont, Ill.). J. Inorg. and Nuclear Chem. 3, 370-8(1957) Jan.

The distribution behavior of U(VI) and Pa(V) in the system aqueous HCl–TBP (tributyl phosphate) without diluent has been investigated at 22 ± 2°C and the results compared with those reported for Th(IV) in the same system. From the comparison, it is postulated that protoactinium extracts respectively as oxygenated and nonoxygenated entities in the regions of low and high concentration of HCl, the transition range being 4–5 M HCl in the aqueous phase. Although the data indicate the feasibility of mutual separation of Th(IV), Pa(V), and U(VI) in the HCl–TBP system, the separation of Pa(V) from U(VI) is much more readily achieved in the (HCl,HF)–TBP system; since the complexing action of fluoride ion is much more pronounced for Pa(V) than for U(VI), under the conditions investigated. A protoactinium sample stored in the form of an (HCl,HF) aqueous solution in a polyethylene container for five years exhibited reversible behavior, the protoactinium extracting into TBP following addition of boric acid to destroy the fluoride complex. There was no evidence of deposition of protoactinium on the walls of the container. Equilibrium was attained rapidly in all protoactinium extractions in which no "nonextractable" protoactinium was involved. The "nonextractable" form converts slowly to the "extractable" form in the presence of hydrochloric acid. The rate of this conversion increases with increasing acid concentration and with increasing temperature. The mutual separation of Th(IV), Pa(V), and U(VI) has been demonstrated for both synthetic and "natural" feeds. (auth)

4371

THE SEPARATION OF CARRIER-FREE TELLURIUM TRACERS BY PAPER CHROMATOGRAPHY. A. S. Ghosh Mazumdar and M. Lederer. J. Inorg. and Nuclear Chem. 3, 379-83(1957) Jan.

Paper chromatographic conditions for the purification of carrier-free Te tracers (from Zr tracer and from Cu in macro quantities), as well as for the separation of Te^{4+} and Te^{6+} ions, have been established. The low R_F values of Te^{6+} in butanol/HCl mixtures have been explained by the tendency of telluric acid to polymerization. (auth)

4372

SEPARATION OF THORIUM AND URANIUM NITRATES BY

ANION EXCHANGE. D. J. Carswell (Atomic Energy Research Establishment, Harwell, Didcot, Berks). J. Inorg. and Nuclear Chem. 3, 384-7(1957) Jan.

The anionic character of Th in HNO_3 solutions has been investigated and distribution coefficients measured. The results have been employed to effect a separation of Th and U by anion exchange. (auth)

Refer also to abstracts 4309 and 4392.

SORPTION PHENOMENA

4373 AERE-C/R-1668

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ABSORPTION OF INORGANIC SALTS BY NON-IONIC RESINS (A NEW ABSORPTIVE MECHANISM). J. Kennedy and H. Small. Nov. 1955. 13p.

Non-ionic insoluble (crosslinked) orthophosphate and phosphonate polymers show high absorption coefficients for UO_2^{2+}, Li, Co^{2+} and Fe^{3+} salts dissolved in alcoholic, alcoholic ether, and ketonic solvents. It is suggested that a Werner addition complex is formed between the metal and the O_2 of the resin phosphoryl group. (auth)

4374

ION EXCHANGE. Henry C. Thomas and Galen R. Frysinger (Yale Univ., New Haven, Conn.). Ann. Rev. Phys. Chem. 7, 137-66(1956).

Ion exchange theory and applications are reviewed. The topics included are: Equilibria in the Ion Exchange Process; Distribution of the Solvent; Cation Exchanges; Anion Exchanges; the Nonexchange Ion and Neutral Molecules;. Kinetics in Ion Exchange; Inorganic Ion Exchangers; Separations Produced by Ion Exchange; Membranes of Ion Exchangers; Catalysis Produced by Ion Exchangers. (T.R.H.)

4375

SURFACE CHEMISTRY AND CATALYSIS. L. H. Reyerson (Univ. of Minnesota, Minneapolis). Ann. Rev. Phys. Chem. 7, 383-402(1956).

Physical adsorption, chemisorption, and surface catalysis are the subjects included in this review. (T.R.H.)

4376

EQUILIBRIUM SORPTION OF LANTHANIDES, AMERICIUM, AND CURIUM ON DOWEX-50 RESIN. J. P. Surls, Jr. and G. R. Choppin (Univ. of California, Berkeley). J. Am. Chem. Soc. 79, 855-9(1957) Feb. 20.

The equilibrium sorption of the tripositive lanthanides and americium and curium from 0.110m perchloric acid solutions on Dowex-50 cation-exchange resin has been studied at 25°. The relative sorbability decreased from lanthanum to dysprosium. From dysprosium to lutetium almost no change in sorbability was observed. Americium and curium sorbed with the same strength as lanthanides of comparable crystallographic radius. A correlation of ion-exchange sorbabilities and ionic conductance at infinite dilution has been made. By studying the effect of temperature on sorption of americium, promethium, thulium and lutetium heats and entropies were obtained. The reaction was found to have a considerable ΔC_p effect. Thermodynamic quantities calculated for americium and promethium differed from those of thulium and lutetium. (auth)

4377

CHROMATOGRAPHY AND SPECTROPHOTOMETRY OF FUSED SALTS. Dieter M. Gruen (Argonne National Lab., Lemont, Ill.). Nature 178, 1181-2(1956) Nov. 24.

Chromatographic adsorption on alumina of transition metal cations, Fe^{3+}, Co^{2+}, Ni^{2+}, Cu^{2+}, and UO_2^{2+} in $LiNO_3 - KNO_3$ eutectic mixtures are discussed. (W.L.H.)

SYNTHESES

4378 NP-6198

Denver. Univ. Denver Research Inst.

DEVELOPMENT OF "CHAIN TYPE" POLYPHENYL AND POLYNUCLEAR AROMATIC COMPOUNDS AS BASE MATERIALS FOR HIGH TEMPERATURE STABLE AND RADIATION RESISTANT LUBRICANTS AND HYDRAULIC FLUIDS. Quarterly Progress Report No. 5 [for] October 15, 1956 to January 15, 1957. Josef J. E. Schmidt and John A. Krimmel. Jan. 15, 1957. 38p. Project 7-(1-3044). Contract AF33(616)-2939.

The synthesis of a number of alkylated polyphenyl compounds for use as base materials for high temperature stable and radiation resistant lubricants and hydraulic fluids is outlined. This report also includes as an appendix a summary on the development of high temperature greases. (auth)

4379 CCC-1024-TR-219

Northwestern Univ., Evanston, Ill.

PREPARATION AND PROPERTIES OF 2,2',2"-NITRILOTRIETHANOL BORATE. C. A. Lucchesi and D. D. DeFord. Jan. 10, 1957. 10p. For [Callery Chemical Co. Contract NOa(s)-52-1024-c].

An improved method has been developed for the synthesis of 2,2',2"-nitrilotriethanol (triethanolamine) borate by simple distillation. Evidence indicates that the tripthych structure predominates over the cage structure, although the transformation to the cage structure may be possible in solution. Chelate formation in water, and especially in butanol, was verified. Additional quantitative solubility data for the nitrilotriethanol borate were obtained. (auth)

4380 CCC-1024-TR-220

Pennsylvania State Univ., University Park.

ATTEMPTED PREPARATION OF SODIUM HYDRIDE IN COORDINATION SOLVENTS. F. N. Daugherty and W. C. Fernelius. Jan. 14, 1957. 17p. For [Callery Chemical Co. Contract NOa(s)-52-1024-c].

Sodium–potassium alloy dissolves to a considerable extent in triethylene and tetraethylene glycol dimethyl ethers and propylene oxide cyclic tetramer as evidenced by the formation of deep blue solutions. Subsequent to the color development in these solutions, a reaction between the solvent and the dissolved metal occurs. Under the conditions employed, these solutions did not take up H_2 to form NaH. The separation of NaH from $NaNH_2$ was attempted by extractions with liquid NH_3, in view of the possible production of NaH from the reaction of $NaNH_2$, and systems containing NaH_2, with H_2. A separation was not accomplished in this manner. (auth)

4381 WADC-TR-57-11

Michigan. Univ., Ann Arbor. Engineering Research Inst.

THE CHEMISTRY OF BORON HYDRIDES AND RELATED HYDRIDES. Annual Report for 1956. R. W. Parry, R. C. Taylor, G. Kodama, S. G. Shore, E. Alton, J. R. Weaver, C. E. Nordman, and C. Cluff. Jan. 1957. 37p. Project 3055. Contract AF33(616)-3343. (AD-118032).

Previous reported work on the ammonia addition compounds of diborane, B_2H_6, has been extended. Three separate compounds of composition $(H_3NBH_3)_n$ have been isolated. Molecular-weight measurements in liquid ammonia are consistent with the three structures H_3NBH_3, $[H_2B(NH_3)_2]$ (BH_4), and $[HB(NH_3)_3]$ $(BH_4)_2$. The monomer H_3NBH_3 has been prepared from B_2H_6 and NH_3 in an excess of diethyl ether. The decomposition of $[H_2B(NH_3)_2]$ (BH_4) in diethyl ether slurry has been studied; H_3NBH_3 is a product of the decomposition. The dipole moment of H_3NBH_3 has been measured in dioxane solution. A value of 4.8 ± 0.1

Debye units was obtained. The ammonolysis of H_2NBH_2 is promoted by alkali metal. The Raman spectrum of H_3BCO has been investigated in some detail. A complete assignment of fundamental frequencies has been made, and a set of valence force constants has been determined which agrees with the experimental data, with a standard deviation of 0.3%. The spectrum of H_3BPF_3 has been obtained and the frequencies have been assigned on the basis of data from H_3BCO. The frequencies assigned to H_3B in H_3BPF_3 are remarkably similar to those assigned to H_3B in H_3BCO. Frequency assignments for the borohydride ion have been completed and force constants have been calculated. The system ammonia-tetraborane (NH_3-B_4H_{10}) has been studied in some detail. The new compound, $B_4H_{10} \cdot 2NH_3$, has been isolated as a white microcrystalline solid. On the basis of chemical arguments the structural formula $[H_2B(NH_3)_2]$ (B_3H_8) has been assigned. Evidence for $B_4H_{10} \cdot 6NH_3$ has been obtained from a pressure composition study. Some evidence for $B_4H_{10} \cdot 7NH_3$ resulted from a time-composition study at −78°C. No evidence for the compound reported by Stock, $B_4H_{10} \cdot 4NH_3$, has yet been obtained. The new compound, $H_3NB_3H_7$, has been isolated and characterized. An x-ray study of $H_3NB_3H_7$ has been conducted. The new compound, Cl_3AlPF_3, has been prepared. At room temperature the halogen atoms change places to give PCl_3 and AlF_3 as final products of the reaction between Al_2Cl_6 and PF_3. (See also WADC-TR-56-318.) (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

4382 AERE-C/M-92

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOLUBILITIES OF SOME PLUTONIUM COMPOUNDS. J. K. Dawson. Nov. 1950. Decl. Dec. 20, 1956. 4p.

Approximate solubilities have been determined for $Pu(NO_3)_4$ and $Pu(NO_3)_6$ in butex and $Pu(C_2O_4)_2$ in water and $(NH_4)_2$ C_2O_4 solutions. (auth)

4383 AERE-C/M-104

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE RECOVERY OF SOLID PLUTONIUM RESIDUES. C. J. Mandleberg. Feb. 26, 1951. Decl. Dec. 20, 1956. 6p.

The solution of Pu oxides and fluorides is discussed, and a recommended procedure is described. A design of a micro furnace for use in laboratory glove boxes is also described. (auth)

4384 AERE-C/M-113

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SOLUBILITIES OF PLUTONIUM TETRANITRATE IN TRI-N-BUTYL PHOSPHATE KEROSENE AND ETHYL ALCOHOL. J. K. Dawson and R. M. Elliott. June 21, 1951. Decl. Dec. 20, 1956. 4p.

Measurements are reported on the solubility at 25°C of solid $Pu(NO_3)_4$ in TBP diluted to 30% with kerosene, aromatic-free kerosene and C_2H_5OH. (auth)

4385 AERE-C/M-157

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A STUDY OF THE REACTION BETWEEN DRY OXYGEN AND PuF_4 AT TEMPERATURES ABOVE 700°C. C. J. Mandleberg, D. Davies, and K. E. Francis. July 18, 1952. Decl. Nov. 1, 1956. 6p.

4386 AERE-C/R-780

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SOLUBILITY OF PuF_3 IN HNO_3/HF MIXTURES, AND THE SOLUBILITY PRODUCT OF PuF_3. C. J. Mandleberg and R. Smith. Sept. 25, 1951. Decl. Nov. 26, 1956. 9p.

The solubility of PuF_3 in HNO_3−HF mixtures is measured. The mean value of the solubility product of PuF_3 is calculated to be 2.5×10^{-16}. (auth)

4387 AERE-C/R-2099

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A NOTE ON THE POTENTIAL OF PLUTONIUM AMALGAM ELECTRODES. A. G. White. Nov. 1956. 13p.

Measurements are reported of the potential of the cell $Pu\ (Hg)_x \mid PuCl_3$ m, HCl 1M || HCl 1M $H_2 \mid$ Pt under various conditions with both flowing and stationary amalgam electrodes. It is shown that the Pu amalgam does not behave as a reversible Pu electrode and a tentative explanation of the phenomena observed is presented. (auth)

4388 AERE-HP/M-80

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A NOTE ON THE BETA COUNTING OF U^{237} AND U^{239}. N. G. Stewart. Sept. 14, 1954. Decl. Dec. 20, 1956. 2p.

The determination of the disintegration rates of samples of U^{237} and Np^{239} by beta counting in an end-window system is rendered difficult by the presence of internal conversion electrons. This report gives the results of experiments carried out to determine over-all correction factors which take account of both counter window absorption and the conversion electron fraction of these two isotopes when measured in a standard EHM2 counter assembly. (auth)

4389

PREPARATION OF URANIUM AND THORIUM TETRAFLUORIDES. A. Cacciari, R. De Leone, C. Fizzotti, and M. Gabaglio (CISE laboratories, Milano). Energia nucleare (Milan) 3, 462-70(1956) Dec.

Less conventional processes for preparation of anhydrous UF_4 and ThF_4 are described. Difluorodichloromethane was used as the fluorinating agent both for UO_2 and ThO_2. Flow sheets and pilot plants for this process are shown. Thorium fluoride can also be produced by a wet process with ammonium fluoride or bifluoride and subsequent transformation into the anhydrous salt with a difluorodichloromethane atmosphere. (auth)

Refer also to abstracts 4287 and 4358.

URANIUM AND URANIUM COMPOUNDS

4390 AERE-C/R-846

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

EQUILIBRIA IN THE SYSTEM URANIUM−HYDROGEN. N. Shulman, J. S. Anderson, and R. C. Blakey. Jan. 3, 1952. Decl. Nov. 26, 1956. 27p.

The equilibrium between gaseous hydrogen and hydrogen in solid solution in metallic U has been studied, at temperatures (550° to 960°) and pressures such that no formation of UH_3 could take place. Small quantities of H are dissolved endothermically by metallic U. The solubility changes discontinuously in passing through the $\alpha \rightleftharpoons \beta$ and $\beta \rightleftharpoons \gamma$ phase changes. The solubility of H in the γ phase is greater than in the β phase, and very much greater than in the α phase. The (endothermic) heat of solution is greatest in the α phase, dissolution of H in γ U being almost thermoneutral. The equilibrium concentration in the metal varies as the square root of the H pressure, showing that H is present in atomic form; the α-phase solution is very non-ideal. Observations on the kinetics can be only partially interpreted. In γ-uranium the diffusion of H is extremely rapid, and surface processes may determine the

rate of absorption or desorption. Diffusion in α U is very slow. The bearing of these observations upon the fabrication of U is discussed. (auth)

4391 AERE-M/M-12

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.]

THE SURFACE ACTIVITY OF VARIOUS URANIUM AND URANIUM ALLOY INGOTS. J. Redfearn and B. W. Mott. [1949?]. Decl. Dec. 20, 1956. 5p. (AERE-HP/M-4).

The increased surface β-activity of U alloy ingots prepared in a vacuum furnace is related to segregation of the Th isotope at the surface, probably due to preferential oxidation. Beta counts of up to 25 times that of normal U have been obtained from the ingot surfaces. The enriched active oxide film can be removed by etching in HNO_3 solutions or by electrolytic polishing after which the material can be safely handled for longer periods than that recommended for normal U. (auth)

4392 CF-57-1-118

Oak Ridge National Lab., Tenn.

URANIUM RECOVERY FOR SPENT FUEL BY DISSOLUTION IN FUSED SALT AND FLUORINATION. G. I. Cathers. Jan. 29, 1957. 19p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A promising non-aqueous process for the recovery of U from spent fuel elements is under development at Oak Ridge National Laboratory. This process consists of dissolution of the fuel element in a fluoride melt by hydrofluorination at 600 to 700°C, direct fluorination with fluorine for the production and volatilization of UF_6, with further decontamination of the product UF_6 from fission product activity being secured in a NaF absorption-desorption step. Good decontamination is obtained in the fluorination step due to the low volatility of most of the fission product fluorides. An over-all decontamination factor of greater than 10^6 with adequate U recovery has been demonstrated in laboratory-scale tests using a double-bed procedure for the NaF step. A pilot plant has been constructed for testing the process with various heterogeneous fuel elements. The engineering and operational features of the pilot plant are described. (auth)

4393 K-1323

Oak Ridge Gaseous Diffusion Plant, Tenn. and Union Carbide Nuclear Co. Paducah Plant, Ky.

A BRIEF GUIDE TO UF_6 HANDLING. J. W. Arendt, E. W. Powell, and H. W. Saylor, comps. and eds. Feb. 18, 1957. 25p. Contract W-7405-eng-26. $0.25(OTS).

Techniques used in the transfer of UF_6 to and from shipping containers are outlined. The physical and chemical properties of UF_6 are also included. (auth)

4394 NYO-7543

Tufts Univ., Medford, Mass.

HIGH TEMPERATURE DISSOCIATION PRESSURE STUDIES OF THE URANIUM–HYDROGEN SYSTEM. Period Covered; March 17, 1955 to December 31, 1956. George G. Libowitz and Thomas R. P. Gibb, Jr. Dec. 31, 1956. 23p. Contract AT(30-1)-1355. $4.80(ph OTS); $2.70 (mf OTS).

Pressure-composition isotherms were obtained for the U–H_2 system over the temperature range 450 to 650°C at pressures up to 65 atm. in a stainless steel apparatus designed for high temperature high pressure measurements. The effect of thermal gradients on the shapes of the isotherms is discussed. The experimentally determined plateau pressures are compared with values extrapolated from low temperature studies of Spedding and Flotow and Abraham. A value of −30.3 kcal/mole was obtained for the heat of formation of UH_3 from the dissociation pressure data. (auth)

4395

STUDIES ON THE HYDROLYSIS OF METAL IONS. 17. THE HYDROLYSIS OF THE URANIUM(IV) ION, U^{4+}. Sirkka Hietanen (Royal Inst. of Tech., Stockholm). Acta Chem. Scand. 10, No. 10, 1531-46(1956).

The hydrolysis of U^{4+} has been studied in a 3M (sodium) perchlorate medium at 25°C by two series of electrometric titrations; in one, $[H^+]$ = h was measured with glass or hydrogen electrodes, in the other, b = $[U^{4+}]$ was measured with a Pt–Pd redox electrode, after the addition of UO_2^{2+}. The data could be explained, assuming the mononuclear reaction $U^{4+} + H_2O \rightleftharpoons UOH^{3+} + H^+$, equilibrium constant β_1, and a polynuclear "core + links" reaction, according to hypothesis IIIa: $(n + 1)U^{4+} + 3\,n\,H_2O \rightleftharpoons U((OH)_3U)_n^{4+n} + 3\,n\,H^+$, equilibrium constant $k_n = k_0 k^n$. The best agreement was found with $\log \beta_1 = -2.00 \pm 0.1$, $\log k_0 = -1.2 \pm 0.3$, $\log k = -3.4 \pm 0.1$. By analogy with Th^{4+} and considering the crystal structure of $U(OH)_2SO_4$ it seems plausible that the complexes are chain-like, of formula $U(^{O}_{OH}U)_n^{4+n}$. (auth)

4396

RADIOCHEMICAL MEASUREMENT OF THE NATURAL FISSION RATE OF URANIUM AND THE NATURAL OCCURRENCE OF Ba^{140}. P. K. Kuroda and R. R. Edwards (Univ. of Arkansas, Fayetteville). J. Inorg. and Nuclear Chem. 3, 345-8(1957) Jan.

Barium (Ba^{140}) was isolated from 4540 g of uranyl acetate. The equilibrium amount of Ba^{140} in the uranium salt was found to be $(1{\cdot}6 \pm 0{\cdot}1) \times 10^{-14}$ c Ba^{140} per gram U^{238}, corresponding to an overall natural fission half-life of uranium of $(5.9 \pm 0.4) \times 10^{15}$ years, assuming a fission yield of 6.1% for Ba^{140}. (auth)

4397

QUINQUEVALENT COMPOUNDS OF URANIUM. I. ALKOXIDES AND COMPLEX CHLORIDES. D. C. Bradley, B. N. Chakravarti, and A. K. Chatterjee (Birkbeck Coll., London). J. Inorg. and Nuclear Chem. 3, 367-9(1957) Jan.

The new complex, $(C_5H_5N)_2UOCl_5$ (I), was obtained from reactions involving UCl_5, $SOCl_2$, alcoholic hydrogen chloride, and pyridine. Reaction of (I) with alcohol and ammonia afforded a novel method of preparing uranium penta-alkoxides $U(OR)_5$ by disproportionation of the oxide-alkoxides initially formed. The new compound, $UOCl_3$,EtOH(II), was isolated from the reaction involving UCl_5,$SOCl_2$ and very dry ethyl alcohol, and this explains the formation. (auth)

Refer also to abstracts 4446, 4451, 4356, and 4371.

WASTE DISPOSAL

4398 AECU-3406

Illinois. Univ., Urbana. Engineering Experiment Station.

THE EFFECT OF RADIOACTIVE SUBSTANCES ON SLUDGE DIGESTION. Final Report. R. H. Harmeson and J. C. Dietz. Jan. 1957. 40p. Contract AT(11-1)-218. $7.80(ph OTS); $3.30(mf OTS); $3.30(mf OTS).

Engineering Experiment Station Bulletin No. 441, available at Univ. of Illinois, $0.85.

A study of the effect of various concentrations and combinations of radioactive materials on the anaerobic digestion of sewage sludges at various temperatures was undertaken. Particular emphasis was placed on P^{32}, I^{131}, and S^{35}. The effects of these materials on digestion was measured by quantitative digestion such as: rate, volume, quality of gas production, pH, acidity, volatile acids, odor, drying characteristics of sludge, and moisture obtained from drying of sludge. (W.L.H.)

4399

LIQUID AND GASEOUS EFFLUENT DISPOSAL. 2. F. R. Farmer (United Kingdom Atomic Energy Authority, H. Q., Risley). Atomics 8, 46-50, 68(1957) Feb.

Aspects of the radioactive effluent disposal problem at the Windscale Works are reviewed. (B.J.H.)

4400

CONCENTRATION OF RADIOACTIVITY IN OXIDATION PONDS. E. W. Steel and Earnest F. Gloyna (Univ. of Texas, Austin). Sewage and Ind. Wastes 27, 941-56(1955) Aug.

ENGINEERING

4401 AECU-3407

Gould-National Batteries, Inc., St. Paul, Minn.

A KAPITZA TYPE NICKEL CADMIUM BATTERY. Report No. 1 [for] July 1955 to October 1955. E. Willihnganz. 16p. Contract AT(30-1)-1831. $3.30(ph OTS); $2.40(mf OTS).

Studies were initiated to develop a Ni–Cd battery with 10 plates of size 35 × 35 cm, discharge time 0.01 to 0.10 sec, life of more than 1000 cycles, and power output of 10 w/cm^2. A description of the equipment and test methods, and the first experiments dealing with positive plate preparation are presented. (W.L.H.)

4402 AECU-3408

Gould-National Batteries, Inc., St. Paul.

A KAPITZA TYPE NICKEL CADMIUM BATTERY. Quarterly Report No. 2 [for] October 1955 to January 1956. E. Willihnganz. 5p. Contract AT(30-1)-1831. $1.80(ph OTS); $1.80(mf OTS).

Further work on the preparation of positive and negative plates is reported. Discharge times of 0.20 to 0.100 sec have been attained. (For preceding period see AECU-3407.) (W.L.H.)

4403 AECU-3409

Gould-National Batteries, Inc., St. Paul.

A KAPITZA TYPE NICKEL CADMIUM BATTERY. Quarterly Report No. 3 [for] January 1956 to April 1956. E. Willihnganz. 21p. Contract AT(30-1)-1831. $3.30(ph OTS); $2.40(mf OTS).

Further tests on plate manufacture, and on separation and battery assembly are discussed. (For preceding period see AECU-3408.) (W.L.H.)

4404 AECU-3410

Gould-National Batteries, Inc., St. Paul.

A KAPITZA TYPE NICKEL CADMIUM BATTERY. Quarterly Report No. 4 [for] April 1956 to July 1956. E. Willihnganz. 6p. Contract AT(30-1)-1831. $1.80(ph OTS); $1.80(mf OTS).

A power output of 3000 kw/ft^3 of active battery volume was attained using miniature cells. A new method of hermetically sealing the cells was studied, as high charge voltage apparently results in cell leakage. (For preceding period see AECU-3409.) (W.L.H.)

4405 AECU-3411

Gould-National Batteries, Inc., St. Paul.

A KAPITZA TYPE NICKEL CADMIUM BATTERY. Quarterly Report No. 5 [for] July 1956 to October 1956. E. Willihnganz. 7p. Contract AT(30-1)-1831. $1.80(ph OTS); $1.80(mf OTS).

A 15-cell Ni–Cd battery was assembled and performance tests began. The plates are 6 in. square and should deliver 5 amp/cm^2 at an average voltage during discharge of 0.8. It should deliver 800 amp at 12 v. (For preceding period see AECU-3410.) (W.L.H.)

4406 DP-189

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

COMPUTATIONS ON THE PERFORMANCE OF A POWER STATION. II. NONAUTOMATIC EXTRACTION TURBO-GENERATORS. Richard R. Haefner. Dec. 1956. 12p. Contract AT(07-2)-1. $0.15(OTS).

A method is described in which an IBM 650 computer is used to determine the electrical output of a steam power station. The output was calculated as a function of high- and low-pressure export steam and boiler output. (auth)

4407 NP-6209

Mine Safety Appliances Co., Callery, Penna.

PROGRESS REPORT 38 FOR DECEMBER 1956 AND JANUARY 1957. W. J. Posey, ed. Feb. 13, 1957. 42p. Contract NObs-65426.

Tests are continuing on the 1000- and 3000-kw steam generators. Two tests were performed with B and W miniature boilers, and results are presented. Corrosion testing of reactor cladding and structural materials in biphenyl at 800°F and 300 psig has been completed. High velocity corrosion testing in isopropyl biphenyl has been completed. The solubilities at high temperatures and pressures of the gases, A, air, CH_4, N_2, and H_2 in organic moderator coolants are presented. (For preceding period see NP-6179.) (W.L.H.)

4408 WAPD-T-66

Westinghouse Electric Corp. [Atomic Power Div.], Pittsburgh.

LOW SPEED ROTARY MOTORS FOR SEALED SYSTEMS. W. E. McCown. [1954]. 10p. Contract [AT-11-1-GEN-14]. $0.15(OTS).

Special low-speed motors of both the canned and slip-on stator types for operation in sealed, pressurized systems are described. These motors are capable of a rotary motion, variable in speed and direction, with positive torque and accurate positioning ability at zero speed. (T.R.H.)

4409

HIGH PRESSURE TECHNOLOGY. Edward W. Comings. New York, McGraw-Hill Book Co., Inc., 1956. 581p.

The equipment, materials, experimental techniques, and general considerations involved in designing high-pressure chemical processes are outlined. (T.R.H.)

HEAT TRANSFER AND FLUID FLOW

4410 AERE-E/R-549

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECT OF FRICTION ON THE FLOW IN VANELESS DIFFUSOR SPACE OF CENTRIFUGAL COMPRESSORS. J. Woodrow. June 1950. Decl. Nov. 1, 1956. 15p. (deleted version: AERE-E/R-817).

The effect of wall friction on the outward spiral vortex flow of a compressible fluid is investigated, in order to assist in the design of centrifugal compressors. Assuming uniform and axially symmetric flow, a constant friction factor and small spiral angle, a second order differential equation is obtained, which can be solved numerically, given the flow conditions at the impeller tip. The conditions of the flow at any radius can then be calculated. The flow pattern and performance of the vaneless diffusor, is found to depend on four non-dimensional parameters. By considering the flow in the neighborhood of a point a simple expression for the local adiabatic efficiency has been obtained. The equation for the flow has been integrated numerically. (auth)

4411 AERE-G/R-2055

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

BIBLIOGRAPHY ON SHOCK WAVES SHOCK TUBES AND

ALLIED TOPICS. K. Dolder and R. Hide. Aug. 1956. 100p.

This bibliography is taken from a card index which was compiled in connection with work on the physical properties of hot gases. References have been arranged under subject headings in chronological order. The sections dealing with shock waves and shock tubes include most of the work published in these fields up to the end of 1955. A number of more recent references are also included. Further sections list accounts of related subjects and the bibliographies previously compiled by the National Physical Laboratory and Princeton University are incorporated. (auth)

4412 AGC-AE-30

Aerojet General Corp., Azusa, Calif.

EXPERIMENTAL STUDIES ON HEAT TRANSFER AND FLUID-FLOW SYSTEMS. Quarterly Progress Report No. 2 [for] October 1 through December 31, 1956. R. B. Edmonson, M. E. Ellion, L. Green, Jr., and K. L. Nall. Jan. 31, 1957. 43p. Project 6-(1-9964). Contract AF33 (616)-3767. (AGC-1310-2).

Design details are presented of components and equipment for the experimental investigation of heat removal by a gaseous coolant from an extended-surface heat source. Design details are included of a transparent-wall nozzle section for flow separation studies and of a spark shadowgraph and Schlieren system. The literature on boiling heat transfer was reviewed as background for the preliminary design of equipment. Progress is reported in the fabrication of equipment and in studies of heat transfer to a flow of cryogenic fluid in the region of its critical point. (12 references.) (C.H.)

4413 ANL-5621

Argonne National Lab., Lemont, Ill.

BOILING DENSITY IN VERTICAL RECTANGULAR MULTICHANNEL SECTIONS WITH NATURAL CIRCULATION (thesis). William Howard Cook. Nov. 1956. 125p. Contract W-31-109-eng-38. $0.65(OTS).

Submitted to Illinois Inst. of Tech.

Boiling density experiments were conducted on $^{7}/_{16} \times 3^{11}/_{16}$-inch channels, two and four feet long, at pressures from 164.7 to 614.7 psia, inlet subcoolings up to 20F and exit steam weight fractions up to 0.15. Power input was varied from 10 to 50 kw/liter for a 5.04-liter coolant volume by resistance heating of $^{1}/_{16}$-inch stainless steel plates. High-resistivity, demineralized water was used throughout the tests. The steam void fraction was studied rather than density because it is conveniently related to the ratio of steam to liquid velocities (v_g/v_f) and the steam weight fraction (x), which are fundamentally involved in continuity of the two phases. Steam void fraction curves normalized with respect to average void fraction demonstrated that thermal equilibrium did not exist over portions of the channel when inlet liquid temperature was below saturation, although thermal equilibrium was again reestablished at the exit of 48-inch long channels. Data of runs with inlet liquid at saturation temperature, where thermal equilibrium was assured, were studied with analytical models for variation of (v_g/v_f) with length using the normalized void fraction plots. A definite change of v_g/v_f with position in the channel was shown to exist, the variation being approximately linear with channel length for runs where inlet liquid was at saturation temperature. Assuming v_g/v_f to be a function of the volume rate of vapor flow and the volume rate of liquid flow, it may be shown that the rate of change of v_g/v_f with length is proportional to the rate of vaporization. Experimental data verified this and showed the change of v_g/v_f with length approaches zero when the rate of vaporization approaches zero. Experiments with unheated riser sections also show this to be true. The conclusion was drawn that the change of $v_g v_f$ reflects the acceleration required to remove steam formed in the channel. Satisfactory correlations of v_g/v_f for saturated inlet conditions were found from plots of v_g/v_f versus volume rate of liquid flow and plots of v_g/v_f versus the ratio of liquid to vapor fractions. These correlations appeared unsatisfactory, however, for data obtained with inlet liquid below saturation temperature. A general correlation was found for all data by use of an analytical model. Plots derived from the analytical model showed v_g/v_f to be a function of the rate of vaporization for liquid inlet temperatures below, and at, saturation, with a small spread due to effects of per cent of the channel length in boiling L_b/L. Values of v_g/v_f at the exit of a two-foot channel were shown to be the values at the corresponding point of a longer channel, indicating that length of channel is not a prime factor in determining phase velocity relationships. Flow and two-phase pressure drop data were obtained for predicting flow in channels. A correlation of the Martinelli ratio of two-phase friction gradient to single-phase friction gradient with mean steam void fraction was satisfactory for all pressures. (auth)

4414 CF-56-12-124

Oak Ridge National Lab., Tenn.

A COLLECTION OF PSEUDO-SHEAR DIAGRAMS OBTAINED IN A LOW TEMPERATURE CAPILLARY TUBE VISCOMETER. R. H. Nimmo and A. S. Kitzes. Dec. 7, 1956. 31p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

A compilation is presented of the rheological data for ThO_2 slurries which were obtained in a capillary tube viscometer. Tests were made with eight slurries at solids concentrations of 400 to 1500 g Th/kg H_2O and at temperatures from 25 to 150°C. The flow curves of the slurries approximated Bingham plastics and yielded estimates of the characteristic properties, yield stress, τ_y, and coefficient of rigidity, η. Both τ_y and η increase with concentration at constant temperature. The degree of flocculation as measured by the apparent yield stresses of the slurries appeared to be changed by heating or simply by standing. In some cases the slurries became thinner when heated, while other slurries became thicker. End effects were found to contribute a measurable part of the pressure drop in the horizontal viscometer tubes. For the two slurries tested, single pseudo-shear diagrams were obtained. It may be concluded that either the slurries were not thixotropic or that thixotropic equilibrium was quickly established near the entrance to the tube. (auth)

4415 K-1302(Pt. II)

Oak Ridge Gaseous Diffusion Plant, Tenn.

THE PROBLEM OF KNUDSEN FLOW. PART II. SOLUTION OF INTEGRAL EQUATIONS WITH PROBABILITY KERNELS. W. C. DeMarcus. Oct. 4, 1956. 27p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Mathematical techniques convenient in solving linear integral equations with probability kernels are given in connection with the general problem of Knudsen flow. (T.R.H.)

4416 NACA-TN-3889

Lewis Flight Propulsion Lab., Cleveland.

PRESSURE LOSSES OF TITANIA AND MAGNESIUM SLURRIES IN PIPES AND PIPELINE TRANSITIONS. Ruth N. Weltmann and Thomas A. Keller. Jan. 1957. 22p.

Experimental and calculated pressure losses are presented for Newtonian fluids and non-Newtonian slurries for laminar, transitional, and turbulent flow in straight pipelines and pipe transitions such as valves, 90° elbows, con-

tractions, and expansions. Transition loss coefficients, which are independent of the flow rate in the pipeline even in laminar flow, were determined for these transitions. It was found that the transition loss coefficients for Newtonian fluids can be used in the calculations for the design of a pipeline system for the non-Newtonian slurries studied. (auth)

Refer also to abstract 4425.

MATERIALS TESTING

4417 AERE-HP/M-43

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

CALCULATIONS OF THE FILTRATION OF AIRBORNE DUST BY FIBROUS FILTERS. R. F. Hounam and J. E. Wilkins. Nov. 21, 1952. Decl. Dec. 20, 1956. 13p.

Recently published formulas are quoted which predict the penetration of small airborne particles through fibrous filters. The formulas are used to calculate the efficiencies of some of the materials used at AERE for air filtration against particles of various sizes over a range of air velocities. (auth)

4418 AERE-HP/M-112

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE PERFORMANCE OF COMPOSITE "KOMPAK" FILTERS IN THE VENTILATION SYSTEM OF BUILDING 351, 1954–1956. R. F. Hounam, Oct. 22, 1956. 5p.

Composite "Kompak" filters loaded with an additional web of superfine fiberglass glass wool as well as the usual web of filterdown have given satisfactory performance as inlet filters in ventilation systems. A service life of two years was obtained before the filters became choked with dust. Tests have yielded no evidence of blow-off from the composite filters. (auth)

4419 PRL-5.19

Pennsylvania State Univ., University Park. Petroleum Refining Lab.

FLUIDS, LUBRICANTS, FUELS AND RELATED MATERIALS. Quarterly Report No. 7 for July, August, and September 1956. Sept. 30, 1956. 78p. Contract AF33 (616)-2851.

The results are given of tests on oxidation characteristics, thermal stability, use of additives, coking values, and lubricity of various materials to be used as high-temperature hydraulic fluids and jet engine lubricants. (For preceding period see PRL-5.18.) (T.R.H.)

4420 WADC-TR-56-370(Pt. II)

Shell Development Co., Emeryville, Calif.

RESEARCH IN HIGH TEMPERATURE BEARING LUBRICATION IN THE ABSENCE OF LIQUID LUBRICANTS. Final Report [for] May 1, 1956 through October 31, 1956. Charles H. Bailey and Stanley S. Sorem. Oct. 1956. 22p. Project title: AVIATION LUBRICANTS. Task title: LUBRICANTS. Contract AF33(616)-2999.

The "protective atmosphere" system for operation of high temperature alloy rolling element bearings at temperatures from 600 to 800°F is being investigated. This system involves surrounding the operating bearing with a special reducing atmosphere. This consists of a "rich" mixture of organic vapor and air with small additions of volatile film forming compounds. The reducing environment prevents the formation of destructive abrasive metal oxides. Reactions of the additive and organic vapor with or on the metal surfaces results in the formation of films which provide the necessary "lubrication" for high temperature operation. Phase I work on mechanisms and atmosphere compositions was continued using size 206 bearings operating under light load at 10,000 rpm. The upper temperature limit of a specific atmosphere composition was found to be 800°F. Possible reasons for the limit are given and means of increasing it are discussed. A group of oxygen and nitrogen containing compounds naturally occurring in JP-4 (approximately 1%w) were found to beneficially effect the nature of the lubricating films formed, thus leading to superior "protective atmosphere" operation. Several representative compounds from this group have been tested individually and of these m-toluidene was outstandingly good. Phase II work, outlining the load, speed, and life characteristics of bearings operated in a "protective atmosphere" was started using size 209 bearings operating at various speeds and loads. A bearing operated at 700°F under ⅔'s of catalog load rating successfully completed 33 hours. Wear was appreciable during this test but compromises in both the mechanical installation and atmosphere composition were necessary in order to work with the available bearings. These may have affected the wear results. (See also WADC-TR-56-370.) (auth)

4421

A RESEARCH PROGRAMME ON BEARING MATERIALS FOR NUCLEAR REACTORS. Alexander Boyd. Can. Mining Met. Bull. 59, 305-9(1956)

A specially designed wear-testing machine is described for testing bearings under reactor conditions. A large number of bearing of different composition were tested without lubrication and with water as the lubricant and preliminary results are presented. (W.L.H.)

PUMPS

4422 HW-46762

Hanford Atomic Products Operation, Richland, Wash.

EVALUATION OF PEERLESS MAGNETIC DRIVE PROCESS PUMP. J. Dunn. Nov. 19, 1956. 9p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

WASTE DISPOSAL

4423 HW-20008

Hanford Atomic Products Operation, Richland, Wash.

THE EFFECT OF THE SPEED OF EMISSION ON THE RISE OF A PLUME OF STACK GASES. Problem 694.55. M. L. Barad. Nov. 20, 1950. Changed from OFFICIAL USE ONLY Jan. 23, 1957. 8p. $1.80(ph OTS); $1.80(mf OTS).

4424 HW-27781

General Electric Co. [Hanford Atomic Products Operation], Richland, Wash.

GROUND LEVEL CONCENTRATIONS IN THE VICINITY OF A 185 FT. STACK. B. Shorr. April 20, 1953. Changed from OFFICIAL USE ONLY Jan. 23, 1957. 20p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The results are presented of a series of field tests designed to measure short-period concentrations at about three stack heights during conditions of marked atmospheric instability and low wind speeds. The data indicate that, relative to a source emitting 1 g/sec from an elevation of 185 ft, it is unlikely that a short-period concentration of 10^{-3} μg/cc or a short-period dosage of 10^{-2} μg sec/cc be exceeded. A nomogram is developed for estimating the probability of exceeding a critical concentration, given the rate of emission and critical concentration.

Measurements of long-period concentrations are presented which show good agreement with Lowry's expression for the maximum concentration during these meteorological conditions. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

4425 AERE-CE/M-188
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
USE OF A RADIOMETRIC TECHNIQUE TO INVESTIGATE THE SETTLING OF AQUEOUS THORIA SLURRIES. J. W. Hitchon. Oct. 29, 1956. 11p.

The distribution of solid in aqueous ThO_2 slurries flowing in a straight horizontal pipe has been investigated using a radiometric technique. The pipe was traversed with a collimated beam of γ-rays, variations in the intensity of the transmitted radiation being measured by a scintillation counter mounted on the opposite side of the pipe. (auth)

4426 CF-57-1-116
Oak Ridge National Lab., Tenn.
DETERMINATION OF SUBMICRON PARTICLE SIZES BY AN ACTIVATION ANALYSIS—CENTRIFUGATION METHOD. L. C. Bate and G. W. Leddicotte. Jan. 29, 1957. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

4427
PROPERTIES OF THORIUM OXIDE CERAMICS. C. E. Curtis and J. R. Johnson (Oak Ridge National Lab., Tenn.). J. Am. Ceram. Soc. 40, 63-8(1957) Feb.

Data are included concerning the strength, density, and porosity that may be expected of thoria ceramics formed by dry-pressing and isostatic pressing and fired at 1400, 1600, and 1800°C. (W.L.H.)

4428
CHEMISTRY OF BERYLLIUM. PART I. FORMATION OF BERYLLATES. Sarju Prasad and Kashi Prasad Srivastava (Banaras Hindu Univ.). J. Indian Chem. Soc. 33, 791-5 (1956) Nov.

The formation of calcium, strontium, barium, magnesium, zinc, cobalt and nickel beryllates has been studied at high temperatures and the following compounds have been obtained: CaO·3BeO, 2CaO·3BeO; SrO·3BeO, 2SrO·3BeO, SrO·BeO; BaO·3BeO; 2BaO·3BeO, BaO·BeO; MgO·3BeO; ZnO·3BeO; CoO·BeO; NiO·BeO. (auth)

CORROSION

4429 HW-35009
Hanford Atomic Products Operation, Richland, Wash.
AN EVALUATION OF BURIED WASTE LINE DESIGN FRACTURE. UNDERGROUND PIPELINE AND STRUCTURE CORROSION STUDY PROGRAM. Interim Report No. 2. R. T. Jaske. Apr. 1, 1955. Changed from OFFICIAL USE ONLY Jan. 23, 1957. Included reprint: EXAMINATION OF 335 MILES OF ASPHALT MASTIC COATED PIPE. Donald E. Miltner. Corrosion 9, 210-15 (1953). 43p. Contract [W-31-109-Eng-52]. $7.80(ph OTS); $3.30(mf OTS).

(For preceding period see HW-33504.) (T.R.H.)

4430 KLX-10057
Vitro Labs., West Orange, N. J.
FISSION PRODUCT SEPARATIONS STUDY. Quarterly Progress Report for September 27–November 30, 1956. Vitro Job 2077. R. A. Keeler, C. J. Anderson, G. V. Delaney, and R. Del Grosso. Dec. 31, 1956. 12p. [For Oak Ridge National Lab., Tenn.] Contract W-7405-eng-26, Subcontract 994. $3.30(ph OTS); $2.40(mf OTS).

Compatibility studies of HNO_3 in stainless steel at 300°C and 1500 psi yielded corrosion rates of 0.3, 0.7, 0.8, and 3.0 mils/run for types 347, 304, 310, and 316. The use of a quartz liner is investigated. Some work with $Al(NO_3)_3$ precipitation and $Sr_2(SO_4)$ solubility in H_2O and HNO_3 at various temperatures is reported. (T.R.H.)

4431 NP-6203
Mine Safety Appliances Co., Callery, Penna.
LETTER REPORT ON CORROSION TESTING IN ISOPROPYL BIPHENYL. Memo Report 126. K. R. Barker, H. E. Cummings, and E. C. King. Feb. 14, 1957. 3p. Contract NObs-65426.

4432 NP-6208
Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.
KINETIC STUDY OF THE CORROSION OF NICKEL IN SULFURIC ACID. Technical Report No. 20. Charles H. Pitt and Milton E. Wadsworth. Jan. 31, 1957. 24p. Project NR-051-192. Contract N7-onr-45103.

The corrosion of Ni in H_2SO_4 solutions in the temperature range of 75°C to 125°C and from 0 to 600 psi partial O_2 pressure was investigated. The variation of rate as a function of agitation, time, acid concentration, and partial pressure of oxygen was determined. The rate was found to be linear over the range of time investigated under the experimental conditions of this study and varied directly with O_2 concentration. A systematic variation of acid concentrations using buffered solutions indicated a process in which the undissociated H_2SO_4 molecule plays an important part. Calculation of the activation energy for the process gave a value of approximately 4 kcal for the rate determining step. The rate determining step was considered to be the adsorption of O_2 on a site containing adsorbed H_2SO_4. (auth)

GEOLOGY AND MINERALOGY

4433 RME-1055(Rev.)
Division of Raw Materials. Denver Exploration Branch, AEC.
AIRBORNE RADIOMETRIC SURVEY OF THE BROWNS PARK FORMATION, CARBON COUNTY, WYOMING. Dan N. Magleby and Neil S. Mallory. Dec. 20, 1954. 20p. $0.20(OTS).

As a result of the Atomic Energy Commission survey, 54 anomalies were located, four of which indicate U deposits of possible economic importance; the deposit at Ketchum Buttes and three anomalies in the area west of Baggs, Wyo., are the most promising. The deposits from which assays of over 0.20% U were obtained are found in a non-calcareous sandstone. The carnotite-type mineral deposits in limestone do not seem to contain sufficient uranium to be considered ore grade. In view of the occurrence of U minerals in the Browns Park formation in the Miller Hill and Baggs area, an airborne radiometric survey of all outcrops in this formation in the Washakie Basin may be profitable. The high background of the Wasatch formation suggests a similar survey on its outcrops might disclose uraniferous deposits. (auth)

4434 RME-1062(Rev.)
Division of Raw Materials. Denver Exploration Branch, AEC.
PRELIMINARY EXAMINATION OF URANIFEROUS LIGNITES, HARDING COUNTY, SOUTH DAKOTA. J. W.

King, J. F. Foran, and A. J. Speal. Aug. 5, 1955. 17p. $0.20(OTS).

Uraniferous lignitic deposits of commercial importance have been found in the vicinity of the junction of North Dakota, South Dakota, and Montana. This report describes the occurrences in South Dakota only. All significant deposits considered here as reserves are found in the "E" bed of the Tongue River member, or in the Ludlow member of the Fort Union formation. The major part of the uranium is present in the lignitic material as a urano-organic complex; metaautunite, metatorbernite, and metazeunerite have been identified. This material contains up to more than 8.0% U_3O_8, and the probable average minable grade is 0.25 to 0.30%. The reserves are based on many scattered deposits, none of which has been thoroughly explored. Sampling and reserve calculations follow the accepted AEC procedure. Inasmuch as the cover ranges from a few inches to 100 feet in thickness, practically all the deposits described are amenable to strip mining. The average thickness of the minable beds is only 12 inches, and the soft nature of the carbonaceous material will require very careful mechanical mining if prohibitive dilution is to be avoided. The weathered lignitic ore is very light–dry weight being 50 lb/ft^3–and consequently, stripping depths should be limited to 50 feet in order to keep mining costs within a profitable figure on 0.25% U_3O_8 ore. The potential field is large and may well develop into a producer of major proportions. (auth)

4435 RME-2025(Rev.)
Salt Lake Area Office, AEC.
SUMMARY OF AIRBORNE RECONNAISSANCE IN THE LITTLE BELT AND CASTLE MOUNTAINS, MONTANA. Olin M. Hart and G. E. Klosterman. June 1956. 9p. $0.15(OTS).

Six anomalies were discovered, five in the Eagle sandstone, and one in an andesite dike. Radioactivity from two to four times background is associated with a sandstone which has a high percentage of magnetite and is found locally in the Eagle formation. The sandstone is thin-bedded and steeply upturned, with the magnetite generally finely disseminated throughout the outcrop areas. The magnetite content varies from a fraction of 1% to an estimated 60%, occurring as thin-bedded concentrates; whereas estimated content of the entire anomalous mass would be 4 to 5%. A pronounced residual deposit of magnetite-bearing sandstone lies over each anomalous area. The result of the weather-resistant quality of the magnetite-bearing zones clearly marks the radioactive areas on the surface. All the anomalies occurring in the magnetite-bearing sandstone are insignificant. The samples from the anomalous rocks assayed 0.01% equivalent U_3O_8 or less. The anomaly on the andesite dike located in Sec. 21, T. 8 N., R. 9 E., has radioactivity averaging about three times background. Assay results were less than 0.01% equivalent U_3O_8. The airborne radiometric survey and field investigations disclosed no significant concentrations of uranium. (auth)

4436 RME-3114
Geological Survey and Bureau of Mines.
SANDY RUN CREEK MONAZITE PLACER, RUTHERFORD COUNTY, NORTH CAROLINA. R. F. Griffith and W. C. Overstreet. Jan. 1953. 27p. $0.25(OTS).

An area of connected flood plains near the headwaters of Sandy Run Creek and its tributaries was one of three monazite placer deposits near Shelby, N. C., recommended by the Geological Survey for investigation by the Bureau of Mines when this cooperative program between the above two agencies was initiated Past production of monazite from small branch streams in this area and the occurrence of known source rocks were factors influencing this selection. Drilling was started on January 14, 1952, and completed on February 1, 1952. Thirty churn-drill holes were completed to bedrock on 75 acres of this deposit for a total depth of 385 feet. The results of this investigation indicate that in the area drilled there are 1,350,000 cubic yards of minable alluvium containing 1,100 tons of monazite, 5,600 tons of ilmenite, 880 tons of rutile, 4,300 tons of garnet, 2,200 tons of sillimanite, 440 tons of kyanite, and 80 tons of zircon. The area that could be worked as a continuous deposit can be extended downstream from the drilled area to include an additional 150 acres. If further exploration proves the tenor of this addition to be comparable to that of the area drilled, the total volume of the deposit would be increased to over 4,000,000 cubic yards and the indicated reserves of monazite to 3,300 tons. The indicated monazite tenor of the lower 30% of the section (the gravel stratum) is 3.3 lbs of monazite per cubic yard as compared with 1.0 lb per cubic yard for the upper 70%. However, the variance in thickness of the gravel stratum and the comparatively shallow depth of the deposit suggest that it would be more economical to mine the entire depth of 11.4 feet than to employ stripping methods. (auth)

4437 RME-3131
Bureau of Mines.
BIG CREEK MONAZITE PLACERS, VALLEY COUNTY, IDAHO. M. H. Kline, E. J. Carlson, and R. H. Storch. Apr. 1951. 24p. $0.25(OTS).

Churn-drill exploration in the Big Creek placer area, Valley Co., Idaho was started by the Bureau of Mines on May 17, 1950 and continued to August 29. Thirty-nine holes, ranging in depth from 30 to 110 ft and aggregating 2,355 ft, were drilled. No bed rock was encountered. A total of 519 samples weighing over 28 tons was recovered. Twenty-two tons of this material was shipped to the Bureau's field laboratory in Boise, Idaho, for concentrating and test; 6 tons representing excess slimes and plus $^1/_8$-in. material was discarded. The results of churn-drilling, sampling and assaying indicated that the area is comparatively large and contains large volumes of gravel which have physical characteristics favorable for dredging operations. In addition to monazite, the placer gravels also contain quantities of ilmenite, garnet, zircon, and magnetite. (auth)

4438 RME-3133
Bureau of Mines.
SCOTT VALLEY AND HORSETHIEF BASIN MONAZITE PLACERS, VALLEY COUNTY, IDAHO. M. H. Kline, E. J. Carlson, and R. H. Storch. June 1951. 22p. $0.20(OTS).

Scott Valley placer area, drained by Big Creek, and Horsethief Basin placer area, drained by Horsethief Creek, are in Valley County, Idaho. Both placers are near each other and separated by a low granite ridge. Late in 1949, a preliminary examination of these areas was made by Bureau of Mines engineers who were searching for radioactive minerals. This preliminary work consisted of hand panning and taking grab samples from the stream bars and gravel banks along Big Creek and Horsethief Creek. The results obtained from this work were favorable, so a proposal was made by the Bureau to do some churn drilling and sampling in the areas. This exploration work was done in 1950 on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission. The objectives of the churn drill exploration were: (1) to determine the quantities of monazite and other black-sand minerals in the gravels, and (2) to determine extent of the placers. Large quantities of black-sand minerals, including monazite, ilmenite, garnet, and zircon, were indicated from the drilling done by the Bureau of Mines in the Scott

Valley and Horsethief Basin areas. Both deposits are accessible by road from Cascade, Idaho, which is also the nearest point of rail transportation. Sufficient water for mining purposes is available for dredging. The removal of second-growth timber in the Scott Valley area would be an added expense which would not occur in the Horsethief Basin area. Based on the results obtained from a limited number of holes drilled in the areas, it appears that the Horsethief Basin area has smaller quantities of black-sand concentrates per cubic yard of gravel than the Scott Valley area, but within this smaller quantity of black-sands, the quantity of monazite is greater, ilmenite much smaller, and garnet and zircon smaller than the Scott Valley gravels. Any mining operation to recover black-sand concentrates from the gravels would require a wash plant. In addition to such an operation, a minerals separation plant would also be needed or have the concentrates custom-treated in other plants. (auth)

4439 RME-3139

Bureau of Mines.

ROCK CREEK RADIOACTIVE MINERAL PLACER AREA, BLAINE COUNTY, IDAHO. A. F. Robertson and R. H. Storch. June 1955. 25p. $0.25(OTS).

The Rock Creek placers are very similar to the Camp Creek deposit located about 6 miles to the west although the black sand concentrates contain different percentages of the heavy minerals. Two of the 3 separated areas along Rock Creek can be mined by dredges; the other area will perhaps require surface mining methods. Power is available in the vicinity. Sufficient water for dredging operations is probably available in Rock Creek only during the late spring months. Water for dredging the largest of the 3 deposits located near the lower end of Rock Creek, may have to be pumped from Magic Reservoir, if year-around operations are to be conducted. The pumping distance will range from ½ mile for the downstream portion of the deposit to over 1½ miles for the upstream end. The heavy black-sand minerals in their decreasing abundance were found to be magnetite, sphene, ilmenite plus hematite, zircon, uranothorite, and others. Screen analyses of a composited sample of black sand concentrates obtained from drill hole JT-28 indicate the uranothorite crystals or grains range in size from minus 35 to minus 200-mesh. Special concentrating equipment may be needed to insure an efficient recovery of the uranothorite from the gravels in the Rock Creek area. The uranothorite contains large percentages of ThO_2 and U_3O_8, and the sphene contains Nb, Ta, Ti, Y, and other rare metals. Little information is available on the metallurgy that will be involved for the separation of the black-sand minerals from each other (auth)

4440 RME-3142

Pennsylvania State Univ., University Park. Coll. of Mineral Industries.

AN INVESTIGATION OF THE AMOUNT AND DISTRIBUTION OF URANIUM IN SULFIDE MINERALS IN VEIN ORE DEPOSITS. Annual Report for July 1, 1955 to March 31, 1956. H. D. Wright and W. P. Shulhof. 29p. Contract AT(49-6)-991. $0.25(OTS).

Material has been collected from 40 deposits in Idaho, Utah, Arizona, New Mexico, and Colorado for a study of the U content and distribution in galena, sphalerite, pyrite, and chalcopyrite associated with pitchblende in vein deposits. Variation in U content of each sulfide is studied relative to variation in ore grade from U-rich to U-poor portions of a deposit, and level of U content of each sulfide is compared between uraniferous and non-uraniferous deposits and districts. (auth)

4441

DECOMPOSITION OF OXIDE MINERALS BY FUSION WITH BORAX. P. G. Jeffery (Geological Survey of Uganda, Entebbe). Analyst 82, 66-7(1957) Jan.

A procedure for decomposition of oxide minerals by borax fusion in Pt is given. The method is demonstrated on mixtures of lime, thoria, and ceria with Nb_2O_5, Ta_2O_5, and Ti_2O_5. (T.R.H.)

4442

MINERALOGICAL EVIDENCE ON THE TEMPERATURE OF FORMATION OF THE COLORADO PLATEAU URANIUM DEPOSITS. Robert G. Coleman (U. S. Geological Survey, Washington). Econ. Geol. 52, 1-4(1957) Jan.-Feb.

Direct evidence of the temperature of formation in the unoxidized U deposit in the Colorado Plateau is generally lacking, and any temperature determination must be based on direct methods. Uranium or U minerals cannot at present be used as temperature indicators, however, the associated sulfides, especially sphalerite, (ZnS) offer a fertile field in establishing the relative temperature of formation. (R.V.J.)

4443

STRUCTURAL CONTROL OF URANIUM ORE AT THE MONUMENT NO. 2 MINE, APACHE COUNTY, ARIZONA. Tommy L. Finnell (U. S. Geological Survey, Denver, Colo.). Econ. Geol. 52, 25-35(1957) Jan.-Feb.

The Monument No. 2 uranium-vanadium deposit is in Monument Valley, Apache County, northeastern Arizona. The uranium and vanadium minerals are in sandstone and conglomerate of late Triassic age, the Shinarump member of the Chinle formation that fills an ancient stream channel cut through the Moenkopi formation of Triassic age and the Hoskinnini tongue of the Cutler formation into the DeChelly sandstone member of the Cutler formation of Permian age. Tyuyamunite, carnotite, becquerelite, corvusite, hewettite, metahewettite, rauvite, and uraninite are the principal ore minerals. They impregnate sandstone, fill fractures, and replace quartz, clay, and fossil plant fragments. The zones of an echelon strike-slip faults cutting post-Moenkopi sedimentary rocks in Monument Valley may be an indication of buried channels and of ore deposits within the channels. Additional tectonic studies in the area are recommended to test the structural interpretation. (auth)

4444

DISTRIBUTION OF SECONDARY URANIUM MINERALS IN THE W. WILSON DEPOSIT, BOULDER BATHOLITH, MONTANA. H. D. Wright and D. O. Emerson (Pennsylvania State Univ., University Park). Econ. Geol. 52, 36-59(1957) Jan.-Feb.

Weathering of pitchblende in the "siliceous reef" deposit at the W. Wilson mine, near Clancy, Montana, has produced an assemblage of secondary uranium minerals, including meta-autunite, meta-uranocircite, meta-torbernite, meta-zeunerite, uranophane, beta-uranophane, phophuranylite, gummite, and an unidentified mineral, possibly a complex uranium silicate. The secondary minerals show a distinct zonation about primary U concentrations. Variation in composition of the groundwater solutions with depth, together with the differences in solubility of the secondary minerals, may be responsible for the zonation. The apparent deposition of the bulk of the U secondaries within a short distance from the primary source, pitchblende, appears to indicate that supergene enrichment in the oxidation zone is not important. The sparse distribution of sulfides in the siliceous veins and the apparent lack of other strongly reducing conditions below the water table would seem to render unlikely the possibility of a pitchblende en-

richment by reduction of the U^{6+} ion in meteoric water moving downward below the water table. (auth)

4445

ZONING OF THE BITTER CREEK VANADIUM-URANIUM DEPOSIT NEAR URAVAN, COLORADO. Allen V. Heyl. U. S. Geol. Survey Bull. 1042-F. 1957. 17p. Price $0.15 (GPO).

The vanadium and uranium deposit of the Bitter Creek mine south of Uravan, Colo., is in the upper part of the Salt Wash sandstone member of the Morrison formation. The deposit is divided into three zones, each having distinctive geologic features. The zones merge, the first into the second and the second into the third, as the thickness of cover on the ore bodies increases. The deepest zone contains nodular and concretionary masses of vanadium-uranium oxides associated with pyrite and chalcopyrite. These masses grade into disseminated deposits of vanadiferous clays and carnotite nearer the outcrop. Similar but less distinctive zones are exposed in many other mines in the Uravan district. The zones represent progressive oxidation of older primary (?) concretionary vanadium-uranium oxide deposits that contained iron and copper sulfides. (auth)

METALS AND METALLURGY

4446 AERE-C/M-243

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

STUDY OF THE RADIOCHEMICAL TECHNIQUE EMPLOYED FOR DETERMINING THE BEHAVIOUR OF FISSION PRODUCT RUTHENIUM IN THE PURIFICATION OF IRRADIATED URANIUM BY ZONE MELTING. R. S. Forsyth and D. F. C. Morris. Mar. 1955. Decl. Nov. 9, 1956. 6p.

Some anomalous results have been obtained in an investigation of the behavior of fission products in the purification of irradiated U by zone melting, especially in the case of Ru. The radiochemical technique employed for determining the behavior of Ru has therefore been studied. It is concluded that non uniform pile neutron irradiation of the U rods used in the experiments, is responsible for the apparently anomalous behavior of the fission products which has been observed. (auth)

4447 AERE-M/R-1181

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

AN APPROXIMATE DETERMINATION OF THE SPECIFIC HEAT OF α-PLUTONIUM. P. G. Mardon, J. A. L. Robertson, and J. G. Ball. Apr. 30, 1953. Decl. Dec. 20, 1956. 11p.

A description is given of a calorimetric method for determining the specific heat of α plutonium. The results are tabulated and a value for the atomic heat of the metal calculated. The significance of the latter result is discussed. The specific heat is found to be 0.036 ± 0.0025 cal/gm/°C over the temperature range 20° to 80°C. This corresponds to an atomic heat of 8.6 ± 0.6 cal/°C. (auth)

4448 AGC-AE-34

Aerojet General Corp., Azusa, Calif.

THE REACTION OF MOLTEN METAL WITH WATER. Progress Report [for] January 1 through January 31, 1957. Feb. 13, 1957. 7p. Contract AT(04-3)-44. (AGC-L2914-23). $1.80(ph OTS); $1.80(mf OTS).

Explosion dynamometer tests were performed on 10g samples of Zr from 3550 to 4670°F, 9g samples of NaK at 120°F, 9g samples of stainless steel at 4120°F, and Al at 2050°C. High-pressure high-temperature corrosion-rate tests were performed on Zircaloy-2 wire in steam at 1000 to 1200°C. (For preceding period see AGC-AE-33.) (W.L.H.)

4449 ARE-50/54

Gt. Brit. Armament Research Establishment, Seven Oaks, Kent, England.

THE USE OF CAESIUM-137 FOR INDUSTRIAL RADIOGRAPHY. R. S. Morgan. Aug. 1955. 18p. (AD-60859).

This report deals with the suitability of Cs^{137} as a gamma-ray emitter for the radiography of steel. An exposure-chart has been produced and penetrameter-sensitivities calculated from experimentally determined broad-beam and narrow-beam absorption curves. The broad-beam curve is approximately linear for steel thicknesses exceeding 0.8 in., and from its slope, it would be expected that Cs^{137} would give radiographs similar in contrast to an x-ray tube operating at about 1.25 million volts peak. Caesium gamma radiation is thus intermediate in quality between iridium and cobalt radiation and this has been confirmed radiographically. While it is a useful source for the examination of steel in the thickness range 1.5 to 4.0 in., below 1.5 in. Ir^{192} is superior, and above 4.0 in. Co^{60} gives better quality radiographs and is essential for penetration. Within the range 1.5 to 3.0 in., where its penetrameter sensitivity reaches its maximum value, Cs^{137} surpasses both Ir^{192} and Co^{60}. Protection data for sources of various strengths have been calculated from an experimentally determined attenuation-curve for Pb. (auth)

4450 BMI-523

Battelle Memorial Inst., Columbus, Ohio.

THE PREPARATION OF LARGE-DIAMETER ZIRCONIUM CRYSTAL BAR BY THE DE BOER PROCESS. H. H. Bulkowski, L. C. Beale, J. J. Sebenick, I. E. Campbell, and B. W. Gonser. Mar. 6, 1951. Changed from OFFICIAL USE ONLY Jan. 11, 1957. 15p. Contract AT(30-1)-771. $3.30(ph OTS); $2.40(mf OTS).

Zirconium crystal bars, 8 feet in over-all length and up to 1.68 inches in diameter, have been produced in a 16-inch-diameter, Hastelloy B, de Boer unit. Twelve experimental runs were made, producing a total of approximately 220 pounds of large-diameter Zr crystal bars. Results of this work have shown that large-diameter crystal bars can be successfully produced in a conventional de Boer apparatus, and that corrosion-resistant metal can be prepared if suitable precautions are taken to avoid contamination of the feed material prior to deposition. The power consumption in the preparation of large-diameter crystal bar was not considered excessive. Analysis of the data obtained in preparing a crystal bar with an average diameter of 1.62 in. showed that it should be possible to produce such bars at a current consumption of 80 to 90 kw/hr/pound. Since the power consumption in present commercial practice is 40 to 60 kw/hr/pound, the additional power consumption does not seem unreasonable in view of other economies that result from use of the large bars in selected operations. (auth)

4451 CF-56-8-135

Oak Ridge National Lab., Tenn.

THE REACTION OF UO_2 WITH ALUMINUM. M. L. Picklesimer. Aug. 7, 1956. 27p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The reaction of UO_2 with Al was investigated by reacting compacts of powder blends of 50 wt. % Al and 50 wt. % UO_2, the latter being made by two different processes which produced oxides of differing physical characteristics. The compacts were held for various times at 615°C in evacuated quartz capsules. The reaction curves for the compacts of the two different oxides were determined by

residue analyses performed by successive chemical leaching operations on reacted compacts. The reaction products, UAl_3 and UAl_4, were identified by x-ray diffraction, and Al_2O_3 by spectrographic analysis. The conclusions reached were that the reaction is not stoichiometric, at least in the earlier stages of the reaction, that the reaction cannot be suppressed but can be slowed sufficiently by quality control of the oxide to permit successful fabrication of fuel plates, and that the primary cause of the major portion of the growth of fuel plates and compacts observed was due to the release of H_2 which had been adsorbed by the oxide during its preparation. A probable mechanism for the reaction is proposed but not conclusively proven. The mechanism involves the production of U_3O_8 as an intermediate product of the reaction. A quick study of the possible direct substitutes for the UO_2 powder, UC, UC_2, U_3Si, and U_3Si_2, showed that all except UC_2 reacted with the Al matrix. Completely successful fuel plates were fabricated from 50 wt. % UC_2 and 50 wt. % Al powder blends, and were tested at a temperature and for time at temperature conditions much more severe than will be encountered in practice. UC_2 powder can be made easily from the pure elements by arc melting and then grinding to powder in an inert atmosphere. (auth)

4452 HW-42547
Hanford Atomic Products Operation, Richland, Wash.
ANALYSIS OF ZIRCALOY-2 CREEP DATA WITH TWO EXTRAPOLATION METHODS. K. R. Merckx. Apr. 17, 1956. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The creep rates for Zircaloy-2 from 300 to 932°F are tabulated, and a mathematical analysis made. (T.R.H.)

4453 ISC-714
Ames Lab., Ames, Iowa.
ELECTRICAL PROPERTIES OF MAGNESIUM SILICIDE AND MAGNESIUM GERMANIDE. Charles R. Whitsett and G. C. Danielson. July 1955. 85p. Contract W-7405-eng-82. $0.50(OTS).

Single crystals of Mg_2Si and Mg_2Ge, of high purity were obtained and measurements were made of their electrical resistivities and Hall coefficients in the temperature range 60 to 1000°K. Both compounds behaved typically as excess impurity semiconductors and exhibited apparent intrinsic conditions above 450°K. (W.L.H.)

4454 ISC-759
Ames Lab., Ames, Iowa.
SEMI-ANNUAL SUMMARY RESEARCH REPORT IN METALLURGY FOR JANUARY–JUNE 1956. Jan. 8, 1957. 42p. Contract W-7405-eng-82. $0.30(OTS).

4455 LEO/A-28
[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.]
THERMAL CYCLING OF URANIUM BARS THROUGH ALPHA–BETA TRANSITION TEMPERATURE. M. B. Waldron and A. G. Harding. [nd]. Decl. Dec. 20, 1956. 3p. (LFLWP-6; FRFEWP-12).

The effect of thermal cycling on U bars of $\frac{3}{8}$-in. diameter, $1\frac{1}{2}$-in. long between 610 and 690°C is studied. (T.R.H.)

4456 NAA-AL-2064-9
North American Aviation, Inc., Downey, Calif.
STATUS OF TITANIUM ALLOY DEVELOPMENT PROGRAM. Progress Report No. 10. Mar. 11, 1955. 22p. Contract AF33-600-28469.

Data are presented on the mechanical properties of Ti–Al–Mn alloys; the effects of various heat treatments on aging and mechanical properties of Ti–Al–Fe–Cr–Mo alloys; and phase studies on Ti–Mn–Al alloys. (C.H.)

4457 NAA-AL-2064-12
North American Aviation, Inc., Downey, Calif.
STATUS OF TITANIUM ALLOY RESEARCH AND DEVELOPMENT PROGRAM. Progress Report No. 13. June 1, 1955. 95p. Contract AF33(600)-28649. (AD-80652).

Electrical resistivity values are presented for Ti–2Al–4V, Ti–4Al–4V, Ti–6Al–4V, and Ti–8Mn alloys at room temperature, -100, and -200°F. The tear test was inadequate as a method for evaluating H embrittlement in Ti–8Mn alloys. Scratches and grinding marks on RC-A110AT alloy sheets adversely affected fatigue strength and forming characteristics; deep short scratches lowered the fatigue strength considerably. Progress is reported on the Ti bolt program. The 3Mn–1Al and RC-A110AT alloys are being used in a fabricating program to study technical problems encountered in the G-38 missile airframe. Tensile tests of Y structures fabricated of RC-A110AT alloys showed the feasibility of the joint with proper tooling and the combination of automatic Heliweld fusion welding and resistance roll seam welding. An investigation of butt-seam resistance weld joints in Ti and 17-7PH stainless steels indicated that butt-seam resistance welding is readily applicable to 17-7PH steel and permits one or both surfaces to be flush; Ti is less readily welded. A fusion welding method is being developed for constructing two Ti alloy test ducts and one low-pressure test tank. Helium gas and weld root gas backing are recommended for welding to overcome the oversensitive arc control. The forging and machining properties of MST-3Al–5Cr and RS- 140X are being studied; RS- 104X was the more difficult to forge. (auth)

4458 NAA-AL-2194
North American Aviation, Inc., Downey, Calif.
TITANIUM ALLOY WELDABILITY AND ASSOCIATED METALLURGY. C. W. Handova and H. L. Meridith. Oct. 26, 1955. 53p. Contract AF33(600)-28469. (AD-80818).

Two high-strength Ti alloys were developed with properties equal to those of the 7% Mn-Ti alloy: RC-A110AT, in α-Titanium alloy, and RS-110BX, an α-β Titanium alloy. Both alloys are readily weldable by the inert-gas, shielded, nonconsumable tungsten electrode process. The weldability of the 2 alloys was determined by bend, tensile, and circular patch weld restraint (CPWR) tests. Weld bend tests showed that the RC-A110AT alloy could adjust itself more readily to bending stresses (minimum bend radius of 5t) in the as-welded condition than the RS-110BX alloy (8t). However, the bend radius for RS-110BX could be improved to 4t by local torch transformation heating of the weld. In either alloy, welds in square butt joints produced weld-joint tensile efficiencies exceeding 100% at room temperature and at 700°F. The as-received RS-100BX alloy was crack sensitive with normal room temperature aging. The CPWR specimens of RS-110BX developed transverse cracks 4 mo after welding. However, specimens which were vacuum annealed prior to welding did not develop transverse weld cracks after welding. Excessive interstitial H caused an unstable condition in the specimens. The RS-110BX alloy should be vacuum annealed before welding. The as-received RC-A110AT alloy was not crack sensitive. CPWR specimens of RC-A110AT were crack free 6 mo after welding. (auth)

4459 NP-6201
Chicago Development Corp., Riverdale, Md.
TITANIUM METALLURGY. PAPER 1. REDUCTION OF TITANIUM CHLORIDE BY SOLUTIONS OF ALKALINOUS METALS IN THEIR FUSED CHLORIDES. R. S. Dean, W. W. Gullett, F. X. McCawley, and I. Hornstein. PAPER 2. THE STRUCTURE OF TITANIUM DEPOSITS FORMED IN ELECTROLYTIC CELLS USING FUSED ALKALI

CHLORIDE BATHS. R. S. Dean, W. W. Gullett, and F. X. McCawley. PAPER 3. THE CHEMISTRY OF THE REDUCTION OF TITANIUM CHLORIDE IN FUSED ALKALINOUS CHLORIDE BY SOLUTIONS OF ALKALINOUS METALS. R. S. Dean, L. D. Resnick, and I. Hornstein. [1956?]. 45p.

4460 NP-6202

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

DEVELOPMENT OF OXIDATION AND LIQUID SODIUM RESISTANT BRAZING ALLOYS. Quarterly Report No. 2 [for] October 15, 1956 to January 15, 1957. Domenic A. Canonico and Harry Schwartzbart. Feb. 5, 1957. 21p. ARF Project No. B-110. Contract AF33(600)-33406.

A program is being conducted by ARF to develop oxidation and liquid Na resistant brazing alloys and a simple ductility test for brazed joints. Three metals, Fe, Cr, and Ni, were selected from oxidation and Na resistance considerations, as the base metals from which to develop acceptable brazing alloys. From a study of all the available phase diagrams, fifty-five alloys have been selected for initial evaluation. Thirty-one alloys have been prepared and examined for melting points between 1700 and 1900°F. Six alloys melted within this range; a seventh had a melting point below 1700°F. All seven alloys were used to braze six-in. long T-specimens. Two alloys had sufficient flowability (3 in.) to be acceptable. These alloys are 45.5 Ni–54.4 In and 40% Ni–30% Cr–30% Ge. A test for the ductility of brazed joints, based on the premise that the load necessary to cause cracking in the fillet of a braze is a measure of the ductility of the brazing alloy, has been studied. To date, the test has not yielded sufficient experimental reproducibility. (auth)

4461 NP-6212

Illinois Inst. of Tech., Chicago.

THE RATE OF REACTION OF NITROGEN WITH HAFNIUM METAL. Technical Report No. 19 [on] CHEMICAL THERMODYNAMICS OF MATERIALS AT HIGH TEMPERATURES. Russell K. Edwards and Glenn T. Malloy. Dec. 1956. 12p. Project 051-070. Contract NONR-1406.

The reaction rate of N_2 with Hf metal was studied in the temperature range 876 to 1034° and over the pressure range 38 to 402 mm. The rate of behavior follows the simple parabolic rate law without deviation for the periods of time studied (up to 132 minutes). The activation energy was found to be 57 kcal per mole of nitrogen. A comparison of these results with other results in the literature shows that rates decrease and activation energies increase in the order, Ti, Zr, Hf, for the nitridization process with this group of metals. (auth)

4462 NYO-6334

Pittsburgh. Univ.

THE HEAT CAPACITIES OF MAGNESIUM AND CADMIUM BETWEEN 20 AND 270°. Progress Report for October 1, 1956 to January 1, 1957. W. E. Wallace, R. S. Craig, W. G. Saba, and K. F. Sterrett. Jan. 2, 1957. 8p. Contract AT(30-1)-647. $0.15(OTS).

(For preceding period see NYO-6332.)

4463 SEP-213

Sylvania Electric Products Inc. Atomic Energy Div., Bayside, N. Y.

NUCLEATION OF VOIDS IN METALS DURING DIFFUSION AND CREEP. R. Resnick and L. Seigle. May 24, 1956. 35p. Contract AT-30-1-GEN-366. $0.30(OTS).

Experimental evidence is presented which proves that voids formed during diffusion in brass are heterogeneously nucleated. The nuclei appear to be oxide particles, probably ZnO. When these are removed by re-melting, voids practically do not form upon subsequent dezincification. Brass which had been freed of void nucleation catalysts exhibited a considerably reduced tendency for grain boundary cracking during creep, and increased stress-rupture life. (auth)

4464 TID-7526(Pt. 1)

Ames Lab., Ames, Iowa.

METALLURGY INFORMATION MEETING, AMES LABORATORY, IOWA STATE COLLEGE, MAY 2, 3 AND 4, 1956. 284p. $1.50(OTS).

The topics included are: Nondestructive Testing of EBWR Fuel Plates; Wetting Temperatures of Fuel Element Components with Na and NaK; Strengthening of Be for High-Temperature Use with BeO and Be_2C Dispersions; Mechanical Metallurgy of Zircaloy-3B; Mechanical Properties and Corrosion Behavior of Zircaloy-3B; Constitution of U and the Pt metals; Production of Th–Bi Dispersions; Preparation of B-Containing Alloys; Al–B and Al–U–B Alloys for Improved Reactor Performance; Radio-analysis of Kr and Xe and Its Use in Diffusion Experiments with Ag; Preferred Orientation in Extruded Th Rod; Morphology of Zircaloy-2; Microstructural Appearance and Identification of Hydrides in Zr and Zircaloy-2–H_2 Alloys; Inspection of Small Diameter Tubing by Eddy Current Methods; Application of Immersed Ultrasonic Technique for the Inspection of Small Diameter Tubes; Corrosion and Mass Transfer by Li at High Temperatures; and Siliconizing of Metals in Liquid NaK. (T.R.H.)

4465 TML-63

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

HAZARDS AND SAFETY PRECAUTIONS IN THE FABRICATION AND USE OF TITANIUM. F. D. Peterseim. Jan. 25, 1957. 22p. Contract AF18(600)-1375.

Pertinent information of the health and safety hazards encountered in production, fabrication, and use of Ti has been reported. The survey indicated that under certain conditions Ti is combustible and explosive; thin chips and fires can ignite and burn with intense combustion and even explode when dispersed in the air. Under some conditions Ti sponge would ignite too, however massive ingots or sheets do not ignite easily. Explosive reactions were observed during stress-corrosion studies of Ti in red fuming nitric acid. Though Ti itself has not been found to be toxic, some Ti compounds, alloying ingredients, and chemicals used in Ti processing are. To date no effective means for extinguishing Ti fires have been found, however, the experience showed that Ti fires can be controlled by the use of conventional powders. (R.V.J.)

4466 WADC-TR-54-17(Pt. 3)

Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.

JOINING OF MOLYBDENUM. [Period covered] January 1955 to February 1956. William N. Platte. July 15, 1956. 84p. Project No. 1252. Contract AF18(600)-114. (AD-110570).

The use of welding atmospheres of purified A and He is shown to cause very little contamination of the weld metal in Mo fusion welds. However, the use of high purity atmospheres provides only a small improvement in ductility over welds made in welding grade A. Increasing the C content of the base material within the range 0.04 to 0.06% appears to improve the ductility of the weld metal. Additions of 0.5% Ti in the presence of 0.05% C gave welds which could be deflected 120° at 80°F. Increasing the C content from 0.015 to 0.05% improved the ductility of the Mo welds containing 0.5% Ti. Additions of 0.16% Al to the Mo yielded welds which could be deflected 120 at 120°F. Exploratory studies

on the effectiveness of diffusion as a method of removal of N_2 from the weld metal are discussed. The use of thermal treatment as a method of improving mechanical properties by over-aging and polygonization was explored. Weld metal additions are also discussed briefly. The use of Ti and Zr as deoxidizers in vacuum sintered molybdenum is described. An exploration into the effects of residual welding stresses showed that the weld crater cracking encountered in many cases is caused by measurable stresses in the region of the weld which approximate the rupture strength of the material. (auth)

4467 WADC-TR-56-469

Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab.

PHASE TRANSFORMATIONS IN HYPOEUTECTOID TITANIUM–CHROMIUM ALLOYS. Period Covered: August 1, 1955 through July 31, 1956. Hubert I. Aaronson, George M. Andes, Walter B. Triplett, Cyril Wells, and Robert F. Mehl. Oct. 10, 1956. 33p. Project title: METALLIC MATERIALS. Task title: THE EFFECT OF COMPOSITION AND INTERNAL STRUCTURE ON THE PROPERTIES OF ALLOYS. Contract AF33(616)-3148. (AD-110682).

The morphologies of proeutectoid alpha in a Ti–Cr alloy have been investigated in some detail and found to be quite similar to those previously observed in the proeutectoid ferrite reaction in plain carbon steels. The most important difference in the two reactions lies in the much smaller amount of undercooling required in the proeutectoid alpha reaction in order to develop plates and sheaves of plates. The eutectoid reaction in hypoeutectoid Ti–Cr alloys was found to consist primarily in the precipitation of alpha and $TiCr_2$ from beta. (auth)

4468 WAL-401/85-32

New York Univ., New York. Coll. of Engineering.

CORRELATION OF TITANIUM PHASE DIAGRAMS. Final Report. Irving Cadoff. May 1956. 23p. DA Project No. 593-08-021. Contract DA-30-069-ORD-1284.

Data for these binary Ti alloys and systems were surveyed: Ti–Al, Ti–B, Ti–C, Ti–Cr, Ti–Co, Ti–Cu, Ti–Ge, Ti–Au, Ti–H, Ti–Fe, Ti–Pb, Ti–Mn, Ti–Mo, Ti–Ni, Ti–Nb, Ti–N, Ti–O, Ti–Si, Ti–Ag, Ti–Ta, Ti–Sn, Ti–W, Ti–U, Ti–V, and Ti–Zr. Phase diagrams of ten of the above alloys are included. These diagrams were grouped and analyzed according to similarities exhibited. Correlations based on size factor, electronegativity, valence, crystal structure, and free energy were made. (W.L.H.)

4469 WAL-847/47

Watertown Arsenal Lab., Mass.

HIGH-VACUUM FILAMENT FURNACE FOR GAS ANALYSIS OF METALS. George A. Consolazio and William J. McMahon. Oct. 28, 1955. 13p. Project title: HEAT RESISTANT MATERIALS. (AD-82546).

A high-vacuum, filament-type, all glass resistance furnace has been designed, constructed and adapted to the inlet system of a conventional mass spectrometer. The specimen is installed either as a small filament between two nickel electrodes or in a small crucible accommodated within a filament coil connected between these electrodes inside the Pyrex shell of the furnace. In this way, temperature and temperature rates are much more closely controlled, operation is simpler, and the installation is more economical than is possible with induction heating. The gases given off at elevated temperatures can be scanned throughout the mass spectrum, or the effusion rate of a particular gas under an imposed set of conditions can be measured as it occurs. (auth)

4470 AEC-tr-2820

THE REACTION OF METALLIC TITANIUM, ZIRCONIUM, HAFNIUM AND THORIUM WITH ACIDS, IN PARTICULAR HYDROFLUORIC ACID. M. E. Straumanis and J. I. Ballass. Translated by D. J. Beernsten from Z. anorg. u. allgem. Chem. 278, 33-41(1955). 6p.

An abstract of the paper appears in Nuclear Science Abstracts as NSA 9-2783. (W.L.H.)

4471

X-RAY DIFFRACTION EFFECTS OF ATOMIC SIZE IN ALLOYS. Bernard Borie (Massachusetts Inst. of Tech., Cambridge). Acta Cryst. 10, 89-96(1957) Feb.

To treat the effect of the difference in size of the atoms in a disordered binary alloy, the elastic model of Huang is modified to treat the two kinds of atoms as two different kinds of distortion centers in an average lattice. Four effects are predicted: a reduction in the intensity of the fundamental reflections by a factor $\exp[-2M']$; a broadening of the short-range-order peaks at higher $(\sin\theta)/\lambda$; a Huang diffuse scattering concentrated near the fundamentals and extended radially in reciprocal space; and a size-effect modulation in the diffuse scattering. The four effects are expressed in terms of a single distortion constant. Measurements have been made on a single crystal of Cu_3Au quenched from 600° C., and all four of the effects have been observed. Within experimental error, the magnitudes of all four effects are represented by the same value of the distortion constant. (auth)

4472

THERMAL AND FORCED DIFFUSION OF OXYGEN IN β-TITANIUM. Fernand Claisse and H. Paul Koenig (Dept. of Mines Labs., Quebec, Can.). Acta Met. 4, 650-4(1956).

This paper reports on a study of the diffusion coefficient and mobility under the influence of an electric field, of oxygen in solid solution in β titanium. The experimental arrangement and the procedure followed is such as to yield a pair of values, one concerning diffusion and one concerning mobility in each experiment. This permits the judicious application of the Nernst-Einstein relationship relating the above-named coefficients to the charge carried by the migrating atom. A negative excess of 0.4 electron units is here found to be carried by the oxygen atoms. The exponential variation of the diffusion coefficient with temperature is best expressed by the following equation: $D = 8.3 \times 10^{-2} \exp[-(31{,}200 \pm 2000)/RT]$. The values in this equation are compared with theoretical and existing experimental values. (auth)

4473

THE METAL BERYLLIUM. D. W. White, Jr. and Je Burke, eds. Cleveland, The American Society for Metals. 1955. 711p.

Sources and uses of Be, its role in the Atomic Energy Program and in industry, the occurrence of the ores, preparation of Be, fluoride and sulfate extraction from beryl, production by electrolysis of $BeCl_2$, methods of fabrication, relation of purity to brittleness in Be, ductility as related to single crystal deformation and fracture and to preferred orientation and grain structure, recovery and recrystallization of cold worked Be, metallography of Be and Be-rich alloys, corrosion in air, water, and liquid metals, preparation of Be-rich alloys, refractory compounds and ceramics of Be, refractory properties of Be oxide, health hazards from Be, and analytical chemistry of Be are discussed. (J.E.D.)

4474

DETERMINATION OF THE SPONTANEOUS DEFORMATION OF THE LATTICE IN FERROMAGNETIC TRANSFORMATION. K. P. Belov and I. K. Panina. (Lomonosov

Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 111, 985-7(1956) Dec. 11. (In Russian)

Spontaneous deformation in ferromagnetic lattices were determined by measuring the relation of magnetostriction to the temperature. The curves for the magnetostriction-magnetizing square for the alloy of 35% Ni, 5% Co, and 60% Fe constructed at various temperatures in the fields of high technical saturation show that at all temperatures magnetostriction has a linear dependence on the magnetizing square and is isotopic in character. The value of spontaneous deformation of the lattice permits an evaluation of the ferromagnetic anomaly of the thermal expansion in ferromagnetics. (R.V.J.)

4475

THE CONSTITUTION OF THE TITANIUM-RICH ALLOYS OF TITANIUM, ALUMINIUM, AND OXYGEN. T. H. Schofield and A. E. Bacon (National Physical Lab., Teddington, Middlesex). J. Inst. Metals 85, 193-5(1957) Jan.

The constitution of the Ti–Al–O_2 alloys containing up to 7.5 wt. % (12.6 at. %) Al and 1 wt. % (3 at. %) O_2 has been determined by microscopical methods up to 1250°C. The α phase field is stabilized by aluminum and oxygen together to temperatures higher than those estimated from the sum of the effects of the two elements independently considered. The results agree substantially with published work by Van Thyne and Kessler (Trans. Amer. Inst. Min. Met. Eng. 200, 193(1954).) (auth)

4476

HEAT TREATMENT RESTORES DUCTILITY TO FORGED TITANIUM ALLOYS. D. N. Williams and R. I. Jaffee (Battelle Memorial Inst., Columbus, Ohio). J. of Metals 9, 254-60(1957) Feb.

4477

EQUILIBRIUM BETWEEN TITANIUM METAL, TITANIUM DICHLORIDE, AND TITANIUM TRICHLORIDE IN MOLTEN SODIUM CHLORIDE-STRONTIUM CHLORIDE MELTS. S. Mellgren and W. Opie (National Lead Co., South Amboy, N. J.). J. of Metals 9, 266-9(1957) Feb.

It has been demonstrated that an equilibrium exists between divalent, trivalent, and metallic titanium in a fused chloride system using sodium and strontium chlorides as solvents. This equilibrium is unaffected by temperature change between 650 and 800°C (within analytical error range of 5%) or by varying the total titanium concentration between 1.7 and 5.0% total titanium in solution. It is markedly affected by varying the $SrCl_2$ to NaCl mole ratio of the solvent, the divalent titanium at equilibrium decreasing with increasing NaCl content. The solutions studied are not ideal. (auth)

4478

THERMAL EXPANSION OF SOME NICKEL ALLOYS. Peter Hidnert. J. Research Natl. Bur. Standards 58, 89-92 (1957) Feb.

Data on the linear thermal expansion of some Ni alloys (Mn-Ni, Hoskins Alloy 667, Inconel, Evanohm, Monel metal, M-M-M alloy, Illium alloy, and Waspalloy) for various temperature ranges between 20 and 1,000° C are given. During the first heating of Inconel alloys (probably with a supersaturated content of C), irregularities were noted in the expansion at about 700° C and were ascribed to precipitation of carbide. The coefficients of expansion of the alloys are tabulated. For the range 20 to 300° C, these coefficients varied from 13.1 to 15.5 $\times 10^{-6}$ per deg C. The effects of additions of Cu, Co, and Fe to Ni-Cr alloys (0 to 24% of Cr) are indicated. (auth)

4479

MOLYBDENUM AS AN ALLOY ADDITION FOR TITANIUM. Harold Margolin (New York Univ.). Metal Progress 71, No. 2, 86-91(1957) Feb.

A 7% Al, 3% Mo alloy has superior strength-weight properties at elevated temperatures. Molybdenum also has favorable influence on hardenability and oxidation resistance. It seems possible that, with its help, a useful age-hardenable alloy can be developed. (auth)

4480

THORIUM'S ROLE IN ATOMIC POWER. John P. Howe (North American Aviation, Inc., Canoga Park, Calif.). Metal Progress 71, No. 2, 97-103(1957) Feb.

This paper was presented at the conference on Th held at the last Metal Congress and Exposition. The nuclear reactions of Th, the production of U^{233} in the CETR, SGR, and LMFR, properties of Th and its alloys, preparation of slurries, refining of spent elements, and the cost of fuel are discussed. (W.L.H.)

4481

A.E.C. POLICY ON THORIUM. Allan M. Labowitz (U. S. Atomic Energy Commission, Washington). Metal Progress 71, No. 2, 108(1957) Feb.

4482

TYPE OF ION MIGRATION IN A METAL–METAL OXIDE SYSTEM. O. Flint and J. H. O. Varley (Atomic Energy Research Establishment, Harwell, Berks). Nature 179, 145-6 (1957) Jan. 19.

A technique to determine the nature of ion migration during oxidation under a relatively small electric field at room temperature is outlined. The metal chosen for study was Zr. (B.J.H.)

4483

HALL EFFECT AND RESISTANCE OF DILUTE GOLD-CHROMIUM ALLOYS AT LOW TEMPERATURES. Werner B. Teutsch and William F. Love (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 105, 487-90(1957) Jan. 15.

A temperature dependence of the Hall effect and of the electrical resistance has been investigated in pure gold and in gold containing 0.03 and 0.05 atomic percent chromium, principally at temperatures in the liquid helium region. For these compositions the temperature dependence of the resistance is abnormal at low temperatures, exhibiting a resistance minimum. No corresponding anomaly was observed in the Hall effect, but neither was it constant as one might expect in terms of a simple theory. Instead, a monotonic increase of the Hall constant with decrease in temperature was obtained below room temperature. This behavior is not influenced by the presence of a resistivity minimum to any appreciable extent. The experimental results favor the interpretation of the resistance minimum as a scattering phenomenon. The specimens were in the form of annealed foils, approximately 20 × 10 × 0.4 mm. A special circuit permitted measurement of the Hall voltages to 0.01 μv, or about 1 part in 1000. (auth)

PHYSICS

4484 AD-59870

American Machine and Foundry Co., Chicago.

TRANSIENT DRAG AND ITS EFFECT ON STRUCTURES. VOL. II. BIBLIOGRAPHY TO FINAL REPORT. M. Lorraine Liggins. Feb. 24, 1955. 73p. Contract AF33 (616)-2285. (MR-1013).

A bibliography on drag forces on blunt obstacles is presented for use in blast loading studies. Some references dealing with structural problems and general fluid flow studies are included. (T.R.H.)

4485 AERE-C/M-137

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England].

LEAKAGE TEST BY THE HELIUM METHOD. E.

Glueckauf and G. P. Kitt. [1952?]. Decl. Dec. 20, 1956. 6p.

A method for determining the extent and location of leakage by the analysis of the rare gases He and Ne has been further developed as a routine test using automatic control. An accuracy of 0.5% for the analysis of a sample containing 0.5 ccs of air has been obtained, but it would appear that the detection of 0.01 ccs of air is the lower limit for the method using a commercial ionization gage. (auth)

4486 AERE-N/R-305

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

DETERMINATION OF THE OPTIMUM THICKNESS OF URANIUM CONTAINER FOR FAST NEUTRON IRRADIATIONS IN A PILE. F. W. Fenning. Jan. 27, 1949. Decl. Dec. 20, 1956. 5p.

Short hollow cylinders of U were used to induce the $Al^{27}(n,p)Mg^{27}$ reaction in Al wires as a measure of the gain in fast neutron flux for irradiation in the Harwell Pile. The maximum gain for 2 in. outside diameter cylinders was found to be a factor 5 for 1.7 cm wall, a factor 4 being obtainable with 1-cm wall. Slightly larger factors were obtained with smaller diameter cylinders. (auth)

4487 BNL-419

Brookhaven National Lab., Upton, N. Y.

QUARTERLY PROGRESS REPORT [FOR] JULY 1 – SEPTEMBER 30, 1956. 47p. $0.35(OTS).

Cosmotron operation and research are briefly summarized. Accelerator development during the period is reviewed as is reactor development. Research within the health physics, instrumentation, biology, and medical departments is surveyed. Abstracts of publications prepared by the various departments are included. (For preceding period see BNL-406.) (B.J.H.)

4488 NP-6195

New York Univ., New York.

RESEARCH OF FLUORESCENCE AND CONDUCTIVITY PHENOMENA. Quarterly Report No. 7 [for] August, September, October 1956. Physics Dept. Hartmut Kallmann. Dec. 1956. 86p. Contract No. DA-36-039-sc-64526.

Studies were begun on the high-energy induced fluorescence of solutions in solid plastics. The circuit used to study the fluorescence is shown. Results are shown for 2 phenyl, 5-(4-biphenylyl)oxadiazole, pyrene, fluoranthene, naphthalene, and 2,5-diphenyloxazole in polystrene. The effect of naphthalene on the γ-induced fluorescence of 2,5-diphenyloxazole in polystyrene is also shown. Data are also shown on the fluorescence of naphthalene and 2,5-diphenyloxazole in polystyrene excited with light at 3025 A. Studies were also made on the effect of strong d-c fields on the a-c photoconductivity of ZnS and ZnCdS powder phosphors. Complete experimental data are tabulated or shown graphically. (For preceding period see NP-6141.) (B.J.H.)

4489 NP-6200

Columbia Univ., New York. Columbia Radiation Lab.

RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM. Quarterly Progress Report No. 4 [for] September 16, 1956 through December 15, 1956. P. Kusch. Dec. 15, 1956. 31p. DA Project No. 3-99-10-022. Contract DA-36-039-SC-64630. (CU-6-56-SC-64630-Phys.).

Seven harmonic generator magnetrons were built and tested. The introduction of an end space tuning device substantially increased the second harmonic output. Alterations made in the two-cavity maser are briefly described. The $J = 0 \rightarrow 1$ rotational transition frequencies and magnetic moments of several isotopic species of carbon monoxide are listed. The quadrupole coupling constant of O^{17} in $C^{12}O^{17}$ was found to be 4.9 ± 0.1 Mc. Measurements were made of the antiferromagnetic resonance of MnF_2 using a new crystal holder assembly. Further measurements were made on the microwave spectrum of CH_3I and on the quadrupole moment of O^{17}. A system for klystron stabilization was developed. (For preceding period see NP-6143.) (B.J.H.)

4490 NP-6207

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 23. Jan. 15, 1956. 60p. Contract N5ori-07856.

Calculations were made of the electronic wave functions of the HF molecule. Many of the results are tabulated. A description of the routine used in the problem is included in an appendix. A calculation was also made of the dipole moment of the ground state of the LiH molecule as a function of internuclear distance. Results are presented in graphical form. The electronic structure of the perfect KCl crystal was calculated by a many-electron, tight-binding method. Calculations of O^- wave functions are also shown graphically. Methods for calculating valence states and molecular binding energies are discussed. A self-consistent molecular orbital calculation on BH was extended to include configuration interaction. (For preceding period see NP-6137.) (B.J.H.)

4491 NP-6211

Victoreen Instrument Co., Cleveland.

BIBLIOGRAPHY ON PHOTOCONDUCTIVITY FOR X AND GAMMA RAY DETECTION. Lewis E. Hollander. Nov. 1956. 10p.

4492 RM-1760(RAND)

RAND Corp., Santa Monica, Calif.

A CASEBOOK ON SOVIET ASTRONAUTICS. F. J. Krieger. June 21, 1956. 248p.

A preliminary attempt is made to uncover evidence of Soviet interest in the subject of astronautics and present it in a suitable, readable form for the edification of readers interested in what the Russians are writing about the problems of space flight. This casebook consists of two principal sections. The first is a four-part bibliography dealing with the historical, scientific, and technical aspects of rocketry and astronautics. The second is a series of complete translations from the Russian (except in three cases) of articles and papers by various authorities selected from a variety of periodicals, and arranged chronologically so that the reader can appreciate the Soviet technique in developing the subject in the open literature. (auth)

4493 WADC-TR-53-471

Dayton, Ohio. Univ.

MEASUREMENT OF PEAK TEMPERATURES WITH THERMAL SENSITIVE INDICATORS. John J. Lucier. June 1954. 11p. Contract AF 33(616)-6. (AD-47530).

Temperature measuring devices referred to as Temp-Tapes were developed for the purpose of measuring peak temperatures induced by thermal energy in solid materials. These devices consist of temperature sensing elements which are held against the material of interest by means of a temperature resistant adhesive tape. Eutectic alloy foils are satisfactory temperature sensing elements when the foils are sufficiently thin and of uniform composition. Present methods of preparing these foils yield products of varying composition and do not permit sufficient thickness control. Individual alloy foils placed directly on the ad-

hesive surface melted sharply, but some difficulty was experienced in interpreting whether or not melting had taken place. Black absorbent paper coated with a sharp-melting white organic pigment is a very satisfactory temperature-sensitive element. On exposure to a nominal temperature, the pigment melts and is absorbed into the black paper, leaving a black appearance. Pigment coatings have been developed with melting point accuracies within 1 to 3°F. A temp-tape utilizing twenty such pigment papers was manufactured and found to be practical. This temp-tape can be improved by reducing its size and by improving the physical nature of the coatings. Temp-tapes based exclusively on organic compounds cannot at the present time measure temperature higher than 500°F. A temp-tape which utilizes pigment papers and eutectic alloys was developed. The addition of alloy foils extended the peak measurable temperature to 635°F, which is the approximate limit of the adhesive on the tape. (auth)

4494 AEC-tr-2832

RESISTANCE POLARIZATION. THE POSSIBILITY OF EXPERIMENTALLY DISTINGUISHING IT FROM OTHER TYPES OF POLARIZATION. Georg Falk and Erich Lange. Translated by K. S. Bevis from Z. Elektrochem. 54, 132-45 (1950). 30p.

The resistance polarization of a silver electrode coated with AgI can be separated from the other basic types, on the basis of the theoretically-estimated different adjustment rates of the individual polarization processes. Direct current measurements made with a cathode ray oscillograph as well as investigations using an alternating current bridge showed that practically pure resistance polarization occurs in this electrode within 1/100,000 second, while the polarization that is built up slowly can be considered, in part, as concentration polarization. (auth)

4495 AERE-Lib/Trans-750

SOME LAWS OF PROPAGATION OF WAVES IN AN HOMOGENEOUS MEDIUM. A. S. Alekseyev. Translated by P. Collins from Doklady Akad. Nauk S.S.S.R. 103, 989-92 (1955). 5p.

4496

CRYOGENICS. R. Berman, A. H. Cooke, and R. W. Hill (Clarendon Lab., Oxford, Eng.). Ann. Rev. Phys. Chem. 7, 1-19(1956).

The third law of thermodynamics and its relation to nuclear spins, isotopic mixtures, configurational entropy, H_2 and D_2, and the melting curve of solid He is discussed. The other subjects included are the liquid He temperature scale and antiferromagnetism. (T.R.H.)

4497

HETEROGENEOUS EQUILIBRIA AND PHASE DIAGRAMS. John W. Tierney and J. M. Smith (Purdue Univ., Lafayette, Ind.). Ann. Rev. Phys. Chem. 7, 21-42(1956).

A review of experimental methods used in phase studies and analytical developments is given. An extensive index to recent periodical literature by systems is included. (T.R.H.)

4498

SOLUTIONS OF NONELECTROLYTES. Robert L. Scott (Univ. of California, Los Angeles). Ann. Rev. Phys. Chem. 7, 43-66(1956)

The general topics included are: Mixtures of Gases; General Theory; Critical Phenomena; Liquid Mixtures; Thermodynamic Properties; Complexes and Compound Formation; Phase Equilibria; Viscosity and Surface Tension of Solutions; and Metallic Solutions. (T.R.H.)

4499

THE SOLID STATE. F. J. Blatt and C. T. Tomizuka (Univ. of Illinois, Urbana) and L. M. Slifkin (Univ. of North Carolina, Chapel Hill). Ann. Rev. Phys. Chem. 7, 311-34(1956).

A review is presented which is limited to: Point Imperfections in Metals; and the Properties of Ge and Si. (T.R.H.)

4500

MELTING CURVES OF HELIUM AND HYDROGEN ISOTOPES. C. Domb (King's Coll., London). Proc. Phys. Soc. (London) B70, 150-3(1957) Jan.

4501

THE ANNUAL VARIATIONS OF SUB-SOIL TEMPERATURES ABOUT A 600-FOOT CIRCLE. Irving A. Singer and Robert M. Brown. Trans. Am. Geophysical Union 37, 743-8(1956) Dec.

To assist engineers in the computations of thermal stresses, thermal loads, and the economic depth to which a protron synchrotron should be buried, the Meteorology Group predicted the annual variations of sub-soil temperatures to the depth of 20 ft. Measurements were made at four stations having various types of ground cover, and located on a circle having a diameter of 600 ft. The analysis of one year of data showed that differences of ground cover have an appreciable effect on the temperature at all measuring depths. Standard thermal diffusion coefficients for a sandy soil are too small to account for the observed range of annual temperatures. (auth)

Refer also to abstract 4449.

AEROSOLS

4502

CONCENTRATION CHANGES IN AN AEROSOL. E. R. Wooding (Imperial Coll. of Science and Tech., London). Proc. Phys. Soc. (London) B70, 65-70(1957) Jan.

The rate of coagulation of an aerosol was calculated by Smoluchowski on the assumption that every collision resulted in the coalescence of two particles. The coagulation rate when there is a potential barrier round the aerosol particles is now calculated and two examples are considered. (auth)

ASTROPHYSICS

4503

PROBABLE EXISTENCE OF RADIOACTIVE MANGANESE-53 IN IRON METEORITES. R. K. Sheline and J. E. Hooper (Univ. of Copenhagen). Nature 179, 85-7(1957) Jan. 12.

COSMIC RADIATION

4504 NP-6196

White Sands Proving Ground. Electro-Mechanical Labs., N. Mex.

COSMIC RAY MEASUREMENTS BY MEANS OF NUCLEAR EMULSIONS. Special Report No. 6. [Covering period] about June 1954 to June 1956. R. E. McDaniel. Jan. 1957. 23p.

Two years' accomplishment (about June 1954 to June 1956) in a program of cosmic ray study with nuclear emulsions at White Sands Proving Ground is presented. The work described is: checking of background by exposing emulsions in ground locations with different amounts of shielding; determination of star count and heavy nucleus flux density at very high altitudes (158 mile peak) from an emulsion exposed in the Viking SN 11 rocket and from a control emulsion on the ground; determination of a correction for star count and heavy nucleus flux density background accumulated during balloon ascent and descent

from an emulsion exposed on a balloon which burst immediately upon reaching peak altitude (120,000 feet) and descended in a few minutes; determination of rate of production of stars at balloon altitude (114,000 feet) from emulsions exposed about eight hours on a balloon flight; study of variation of star production with altitude at terrestrial altitudes by exposure of emulsions at 4,100, 9,050, and 11,550 foot levels; incidental identification of 200 π meson events observed during the total scanning of the approximately 25 cubic centimeters of emulsion employed to obtain the star and flux data, and classification into negative and positive pion events. Photomicrographs of three typical very high-energy events which were observed are presented. (auth)

4505

ELECTROPHOTONIC COMPONENT OF COSMIC RADIATION AT GREAT DEPTHS. Louis Avan and Madeleine Avan. Compt. rend. 244, 450-2(1957) Jan. 21. (In French)

The interactions of relativistic μ mesons at great depths cause the generation of an electrophotonic component by three fundamental processes—creation of collision electrons, photon emission from bremsstrahlung, direct creation of pairs-and their developments in cascades. (tr-auth)

4506

NUCLEAR INTERACTIONS OF μ MESONS UNDERGROUND. VARIATION OF THE PROTON AND π-MESON FLUX WITH DEPTH. Louis Avan and Madeleine Avan. Compt. rend. 244, 589-92(1957) Jan. 28. (In French)

4507

RELATIVE ABUNDANCES OF DIFFERENT CHARGE GROUPS OF HEAVY PRIMARY COSMIC-RAY NUCLEI. J. H. Noon, A. J. Herz, and B. J. O'Brien (Univ. of Sydney). Nature 179, 91(1957) Jan. 12.

4508

ABUNDANCES OF METEORIC LEAD ISOTOPES. R. D. Russell (Univ. of Toronto). Nature 179, 92(1957) Jan. 12.

4509

A NEW APPROACH TO THE CASCADE THEORY. Alladi Ramakrishnan and S. K. Srinivasan (Univ. of Madras, India). Proc. Indian Acad. Sci. 44, 263-73(1956) Nov.

The cascade theory of cosmic rays is investigated from a new point of view. The number of particles produced in a certain thickness of matter, the energy of each particle being greater than E at the point of its production, is considered. This new approach leads to an elegant asymptotic theory for large thicknesses and it is better adapted to the interpretation of experiments in nuclear emulsions. (auth)

4510

A STUDY OF THE SOLAR DAILY VARIATION OF MESON INTENSITY AT AHMEDABAD (λ = 13° N) USING A CUBICAL MESON TELESCOPE. Krishna Ramanathan (Physical Research Lab., Ahmedabad). Proc. Indian Acad. Sci. 44, 307-20(1956) Nov.

4511

SOLUTION OF THE FUNDAMENTAL DIFFUSION EQUATION FOR COSMIC RAY PARTICLES EMITTED BY A CONSTANT ENERGY CONCENTRATED PULSED SOURCE. Iu. A. Popov (Moscow State Univ.). Soviet Phys. JETP 4, 85-90(1957) Feb.

The fundamental diffusion equation deduced by Terletskii for cosmic ray protons emitted in magnetized interstellar space during a short period of time by a concentrated source of given energy is solved. It is shown that consideration of the particles which remain after collision of cosmic ray protons with protons of the interstellar gas leads to a power spectrum similar to that observed experimentally, if the source is assumed to be a supernova which appeared in the center of the galaxy over 10^8 years ago. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

4512

THE CRYSTAL STRUCTURES OF PuAs, PuTe, PuP AND PuOSe. Alvin E. Gorum (Los Alamos Scientific Lab., N. Mex.). Acta Cryst. 10, 144(1957) Feb.

4513

CRYSTALLOGRAPHIC DATA: URANIUM TETRABROMIDE, UBr_4. R. M. Douglass and Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 29, 459(1957) March

4514

RADIATION DAMAGE IN LANTHANUM MAGNESIUM NITRATE CRYSTALS CONTAINING RADIOACTIVE ISOTOPES. B. Bleaney, W. Hayes, and P. M. Llewellyn (Clarendon Lab., Oxford). Nature 179, 140-2(1957) Jan. 19.

Observations were made of the paramagnetic resonance spectrum of lanthanum magnesium nitrate containing two different radioactive isotopes, Am^{241} and Pm^{147}. Data concerning the spectrum are tabulated. (B.J.H.)

Refer also to abstracts 4551 and 4766.

ELECTRICAL DISCHARGE

4515 UCRL-4769

California. Univ., Livermore. Radiation Lab.

PLASMA CONFINEMENT AT UNIFORM TEMPERATURE. Cornelius H. Woods. Oct. 24, 1956. 31p. Contract W-7405-eng-48. $0.25(OTS).

The hydromagnetic equations are solved to determine the properties of a plasma confined in the steady state by a magnetic field. The steady state is presumed to be realized by injecting neutral particles which subsequently become ionized and replace the particles lost by diffusion. Assuming uniform temperature throughout the plasma makes possible analytic determination of the macroscopic quantities of interest. These include the electric and magnetic fields, current density, particle density, and macroscopic velocity. In the first case treated, the region of confinement lies inside a circular cylinder of infinite length, and in the second case within the space between two parallel planes. A comparison is made between uniformly distributed injection and concentrated injection, and an estimate is given of the decay time after injection ceases. (auth)

4516

PRE-BREAKDOWN CONDUCTION BETWEEN ELECTRODES IN CONTINUOUSLY-PUMPED VACUUM SYSTEMS. W. K. Mansfield and R. L. Fortescue (Univ. of London). Brit. J. Appl. Phys. 8, 73-8(1957) Feb.

Electron loading in electrostatic generator accelerator tubes due to the passage of pulses of current of millisecond duration has been investigated. The characteristics of pulse discharge conduction are described and a theory of its origin proposed. This theory envisages an exchange positive and negative ions of hydrogen between the electrodes in a regenerative reaction, the source of the ions being a chemi-sorbed layer of hydrocarbon on the electrode surfaces. Measurements of the secondary emission coefficients and other experimental evidence appear to be consistent with such a hypothesis. Methods of suppression of this pulse discharge conduction are discussed. (auth)

4517

THERMONUCLEAR REACTION RATES. W. B. Thompson (Atomic Energy Research Establishment, Harwell, Didcot, Berks). Proc. Phys. Soc. (London) B70, 1-5(1957) Jan.

It is shown that the thermonuclear reaction rate between two gases in thermal equilibrium and of densities n_1 and n_2 nuclei per unit volume can be written as $n_1 n_2 \langle \sigma v \rangle$ where $\langle \sigma v \rangle$ is a suitable average of the product of the reaction cross

section and relative velocity, and for any reaction is a function of temperature alone. These functions are given for a number of exoergic reactions between light nuclei. (auth)

4518

SOME CRITERIA FOR A POWER PRODUCING THERMONUCLEAR REACTOR. J. D. Lawson (Atomic Energy Research Establishment, Harwell, Berks). Proc. Phys. Soc. (London) B70, 6-10(1957) Jan.

Calculations of the power balance in thermonuclear reactors operating under various idealized conditions are given. Two classes of reactor are considered: first, self-sustaining systems in which the charged reaction products are trapped and, secondly, pulsed systems in which all the reaction products escape so that energy must be supplied continuously during the pulse. It is found that not only must the temperature be sufficiently high, but also the reaction must be sustained long enough for a definite fraction of the fuel to be burned. (auth)

4519

EQUILIBRIUM CHARACTERISTICS OF A PINCHED GAS DISCHARGE COOLED BY BREMSSTRAHLUNG RADIATION. R. S. Pease (Atomic Energy Research Establishment, Harwell, Berks). Proc. Phys. Soc. (London) B70, 11-23(1957) Jan.

Standard formulas for the electrical resistance and for the radiating properties of a fully ionized gas have been combined with pinch-effect relations to obtain the stationary state radial distribution functions and current-voltage characteristics of a radiation-cooled discharge, using a simplified model in which a stationary, axially symmetrical discharge is generated in a long straight tube. The validity of the diffusion conditions implied in the initial equations, the transport properties of the plasma, and the cyclotron radiation arising from thermal motion in the self-magnetic field, are considered. The calculations are applied to the requirements of a power-producing thermonuclear reactor. The chief results are that in a stationary state a pinched discharge will exist with radiation cooling, that the magnitudes of the voltages, tube diameters, and initial gas pressure are within reasonable engineering limits, and that a maximum current of one to two million amperes will be encountered. This maximum is a characteristic current of an ionized gas and, slowly varying numerical factors apart, depends directly only on the fundamental constants e, m, h, and c. While it is possible to present grounds for supposing these results to be independent of some of the assumptions, the work gives no guidance on the extent to which they will be invalidated by the instabilities of the current channel. (auth)

4520

AN ELEMENTARY THEORY OF THE TRANSIENT PINCHED DISCHARGE. J. E. Allen (Atomic Energy Research Establishment, Harwell, Berks). Proc. Phys. Soc. (London) B70, 24-30(1957) Jan.

A simple theory of the collapse of a high current discharge plasma is described. The theory applies to discharges of the type studied by Cousins and Ware, in which shock waves are generated by the self-magnetic 'pinch' forces. (auth)

4521

HYDROMAGNETIC INSTABILITIES OF AN IDEALLY CONDUCTING FLUID. R. J. Taylor (Atomic Energy Research Establishment, Harwell, Berks). Proc. Phys. Soc. (London) B70, 31-48(1957) Jan.

Some hydromagnetic instabilities of a cylindrical ideally conducting fluid, which is confined by the pinch effect of an axial current, are considered. Kruskal and Schwarzschild [Proc. Roy. Soc. A223, 348(1954)] have previously studied the instabilities of a fluid carrying a surface current. A volume current distributed according to a power law is considered here, and some general stability criteria and values of maximum possible growth rates are obtained. The volume current is more stable than the surface current, and in particular an infinite instability at short wavelength is replaced by one of finite growth rate. Finally, viscosity is introduced into the plasma carrying a surface current; disturbances at very short wavelength are damped, and a first approximation is obtained to a wavelength of maximum instability. (auth)

4522

OBSERVATIONS OF THE INSTABILITY OF CONSTRICTED GASEOUS DISCHARGES. R. Carruthers and P. A. Davenport (Atomic Energy Research Establishment, Harwell, Berks). Proc. Phys. Soc. (London) B70, 49-50(1957) Jan.

Observations of gaseous discharges in both straight and toroidal discharge tubes have shown that a constricted current channel becomes unstable at a particular value of current. Discharges have been studied up to currents of 1500 A and high-speed photographs are reproduced which indicate the helical form of these unstable current channels. (auth)

ELECTRONS

4523

MODIFIED DEFORMABLE POTENTIAL FOR THERMAL SCATTERING OF ELECTRONS. John B. Gibson and Joseph M. Keller (Iowa State Coll., Ames). Phys. Rev. 105, 476-9(1957) Jan. 15.

In order to study thermal scattering of moderately bound electrons in a metal, corrections are considered to a deformable scattering potential. A constant multiple of the dilatation is derived that must be added to account for the correct zero of potential in a homogeneously deformed crystal. In an inhomogeneously deformed crystal (a crystal undergoing thermal vibrations), a function of the strain must be added to take care of charge redistribution. The deformable potential must also be modified to treat umklapp processes consistently. The modification provides that as the phonon wave vector increases in magnitude, some umklapp character must gradually be added to the scattering amplitude. (auth)

4524

DISCRETE ENERGY LOSSES OF ELECTRONS REFLECTED FROM A MoO_2 SURFACE. N. B. Gornyi. Soviet Phys. JETP 4, 131-3(1957) Feb.

The method of electronic differentiation in a spherical capacitor circuit was used to investigate the discrete energy losses of electrons reflected from a MoO_2 surface. The curves of the energy distribution of the reflected electrons have a series of clearly defined peaks. (B.J.H.)

GASES

4525 AERE-GP/R-2028

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

RADIATION FROM GASES. W. R. Hindmarsh. Aug. 28, 1956. 33p.

Brief discussions of Boltzmann's and Saha's equations, Stefan's, Planck's, and Kirchhoff's laws, and natural, Doppler, and pressure spectral line broadening are presented. (D.E.B.)

4526 CF-57-1-93

Oak Ridge National Lab., Tenn.

ESTIMATION OF THE THERMAL CONDUCTIVITY AND THE VISCOSITY OF GASES AT HIGH PRESSURE. R. N.

Lyon. Jan. 17, 1957. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

4527 NYO-7314

Princeton Univ., N. J. Project Matterhorn.

OSCILLATIONS OF A CYLINDRICAL PLASMA. Thomas Stix. [1956?]. 15p. (PM-S-24). $3.30(ph OTS); $2.40 (mf OTS).

The natural modes of oscillation of a cylindrical plasma of finite density at zero pressure in a longitudinal magnetic field are examined. Considering frequencies well below the electron plasma and electron cyclotron frequencies, there appear in two limiting cases hydromagnetic waves, and waves whose natural frequencies are close to the ion cyclotron frequency. This cyclotron frequency resonance occurs when the wave length of the oscillation in the z direction is short compared to the wave length for light in vacuo corresponding to the root square sum of the ion plasma frequency and the ion cyclotron frequency. (auth)

4528

AUTOMODEL MOTION OF GAS IN A STRONG PERIPHERAL EXPLOSION. G. L. Grodzovskiĭ (Zhukovskii Central Inst. of Aero-Hydrodynamics). Doklady Akad. Nauk S.S.S.R. 111, 969-71(1956) Dec. 11. (In Russian)

Studies were made of the automodel flow in a strong explosion inducing the motion of a strong impact wave toward the symmetry center of the inert gas density ρ, (the pressure of the inert gas was taken negligibly small in comparison with the pressure beyond the impact wave). Results are given of the calculations made of the profile, density, pressure, and temperature for laminar, cylindrical, and spherical cases. (R.V.J.)

4529

FIELDS ON PLASMA IONS BY COLLECTIVE COORDINATES. Arthur A. Broyles (The RAND Corp., Santa Monica, Calif.). Phys. Rev. 105, 347(1957) Jan. 15.

A discussion is given of the results of applying an improved method, employing collective coordinates, to the evaluation of the n-dimensional integrals occurring in the problem of determining the probability that a given electric field will appear on an ion in a plasma. (auth)

4530

KINETICS OF REACTIONS IN GASES. George Porter (Univ. of Sheffield, Eng.). Ann. Rev. Phys. Chem. 7, 207-30(1956).

A review of work in the kinetics of reactions in gases is presented. (T.R.H.)

INSTRUMENTS

4531 AECU-3362

Illinois. Univ., Urbana. Electrical Engineering Research Lab.

THE HARMODOTRON—A BEAM HARMONIC, HIGHER ORDER MODE DEVICE FOR PRODUCING MILLIMETER AND SUBMILLIMETER WAVES. Technical Report No. 1. M. D. Sirkis. Sept. 10, 1956. 237p. Contract AT(11-1)-392. $1.25(OTS).

A new method for the generation of relatively high powers at submillimeter wavelengths through the excitation of a single selected TM_{omn} mode in a cylindrical cavity is theoretically investigated by means of a field theory approach. Experiments at a wavelength of 8.310 millimeters which successfully demonstrate the method are described. The oscillation in the cavity is excited by a high energy (1-Mev range), bunched electron beam, produced by a single cavity electron accelerator operating at 2775 megacycles per second. It is shown that satisfactory coupling between the electron beam and the field within the resonant cavity is possible only for beam velocities approaching the velocity of light. The bunched electron beam contains current frequency components at high harmonics of the 2775 megacycles per second fundamental frequency. The cylindrical cavity is tuned to resonate at one of these harmonics. The theoretical relationship between the generated power, p, and the harmonic current component, I_n, is typically of the order of $p(\text{watts}) \cong 3{,}000[I_n\ (\text{amps})]^2\sqrt{\lambda(\text{mm})}$ for a 1-Mev electron beam. If a harmonic current amplitude of 100 milliamperes (a reasonable value) is assumed, the theory predicts a pulsed generated power of approximately 30 watts at a wavelength of one millimeter. (auth)

4532 AERE-CP/R-1966

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

COUPLING OF RESONANT CAVITIES BY RESONANT COUPLING DEVICES. P. D. Dunn, C. S. Sabel, and D. J. Thompson. Dec. 1956. 46p.

It is shown that the degree of coupling between cavity resonators can be considerably increased by resonating the coupling device, and a method is given of realizing this in practice. A theory is given for loss-free structures that is in agreement with the experimental evidence. The theory is extended to take account of the modification of the dispersion characteristic in the cut-off frequency regions due to the introduction of loss. It is shown that by using this theory it is possible to predict the frequency behavior of π-mode structures from measurements on single elements. (auth)

4533 AERE-GP/R-1741

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

EFFECT OF MISMATCH IN R. F. FEEDBACK SYSTEMS. L. B. Mullett and R. B. Robertson-Shersby-Harvey. Oct. 20, 1955. 17p.

The effect of mismatch in an r-f feedback system applied to an accelerator is analyzed in detail, and the conclusion is drawn that for feedback ratios up to three the system should be realizable with little deviation from ideal efficiency. Beyond a ratio of three, deviations from ideal conditions become extremely serious, and somewhere between five and ten, the limitations imposed by manufacturing tolerances and experimental techniques suggest that a purely resonant system should replace the travelling-wave system with feedback. (auth)

4534 AERE-NP/R-2043

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A TEST PULSE GENERATOR FOR USE WITH THE HARWELL 15 MeV LINEAR ACCELERATOR AND THE ASSOCIATED NEUTRON TIME-OF-FLIGHT EQUIPMENT. F. W. K. Firk. Sept. 26, 1956. 21p.

A pulse generator for use with the Harwell 15-Mev linear accelerator and the associated time-of-flight equipment is described. The duration of the timing channels can be measured to an accuracy of ±20 mμ sec under working conditions. Provision is also made for the determination of the true "zero-of-time" for the spectrometer; a coincidence technique is used to assess the distribution in time of individual neutron pulses from the machine. (auth)

4535 AERE-RP/M-29

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETECTION OF SOFT X-RAYS IN THE PRESENCE OF HARD GAMMA RADIATION—A POSSIBLE APPLICATION TO REACTOR TECHNOLOGY. B. T. Price and E.

Healy. Jan. 11, 1954. Decl. Dec. 20, 1956. 10p.

The 5-kev K x ray of chromium can in principle be used to detect corrosion of a stainless steel reactor tube by a liquid metal coolant. The design of counting equipment for the efficient detection of such x rays in the presence of large γ-ray backgrounds is discussed. (auth)

4536 BNL-408

Brookhaven National Lab., Upton, N. Y.

TWIN CHANNEL COUNT INTEGRATOR (EH1-503). W. A. Hinginbotham and J. Tillinger. June 1956. 21p. $0.25 (OTS).

A dual channel precision recording ratemeter is described in detail. It employs count integrating circuits which are operated for preset counting intervals of 15 to 120 seconds duration. Meter ranges are 2000 to 100,000 counts per minute, full scale. After warmup the accuracy is better than 0.25% of full scale. Count ratemeter and count integrator circuits are discussed and the sources of error and drift are analyzed. An example of the use of this instrument to study the transcapillary exchange of isotopes in the blood stream is given in the appendix. (auth)

4537 CF-57-1-89

Oak Ridge National Lab., Tenn.

TEST OF STAINLESS STEEL FREEZE JACKET TO BE USED ON $\frac{1}{2}$-INCH HIGH PRESSURE AND HIGH TEMPERATURE PROCESS LINES. B. D. Draper. Jan. 21, 1957. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

In order to test the operation of a freeze jacket in air with the process fluid closely following the conditions found in the high pressure circulating loop of a homogeneous reactor, or, 2000 psi and 300°C, a test loop was built and used in conjunction with existing refrigeration equipment. The freeze jacket was made of $\frac{5}{16}$-in. type 347 stainless steel tubing wrapped around and welded to a $\frac{1}{2}$-in. stainless steel process line. It was concluded that for these reactor operating conditions, only a small leak rate, 11 cc/min, could be frozen off. It is recommended that, at the beginning of the freezing operation, the temperature of the secondary refrigerant entering the freeze jacket be at least −40°C and that the freeze jacket be made as long as practical. (B.J.H.)

4538 CF-57-1-106

Oak Ridge National Lab., Tenn.

EDDY-CURRENT MEASUREMENT OF CLAD THICKNESS ON MARK X MTR FUEL PLATES. R. B. Oliver, J. W. Allen, and R. A. Nance. Jan. 23, 1957. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Designs are given of a prototype instrument and probe coil utilizing the eddy-current principle. The instrument was developed to measure clad thickness on Mark X MTR fuel plates. Results of the investigation indicate that clad thickness can be measured to within ±0.001 in. (B.J.H.)

4539 DF-55A0405

General Electric Co., Schenectady, N. Y.

MINIATURE MAGNETIC AMPLIFIERS WITH HIGH FREQUENCY POWER SUPPLIES. W. R. Seegmiller. Oct. 11, 1955. 44p.

Results of preliminary development of miniature magnetic amplifiers with high frequency transistor oscillator power supplies are presented. Fullwave and half-wave miniature stages have been constructed in breadboard form and evaluated for power gain and transient response. Data on the transistor oscillator supplies are also included. (auth)

4540 HW-36210

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

METALLURGICAL EXAMINATION OF RESISTANCE THERMOMETER ELEMENTS—REAR FACE 100-K AND PROTOTYPE UNITS 100-H AREAS. Lewis S. Reed, L. A. Hartcorn, and W. R. Smith. April 18, 1955. Changed from OFFICIAL USE ONLY Jan. 23, 1957. 8p. $1.80 (ph OTS); $1.80(mf OTS).

All the units which were examined after being in service only a short time exhibited some corrosion attack on the brazed joints, and the brazed joints on the units which had been in service for periods up to a year were so extensively corroded that little or no braze metal remained. It is concluded from this examination that the Ag brazing alloy used to make these units is not suitable for joining type 416 stainless steel to type 305 stainless steel in this service. (auth)

4541 HW-40296

Hanford Atomic Products Operation, Richland, Wash.

STABILITY OF CHROMEL—ALUMEL THERMOCOUPLES IN CARBON DIOXIDE AT 1000°C. H. H. Burton. Nov. 29, 1953. 4p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Tests on twenty identically prepared 26-gage chromel–alumel thermocouples have been completed. It appears that wires of this material without protection are unsatisfactory mechanically and thermoelectrically for service in atmospheres of CO_2 at 1000°C. (auth)

4542 ISC-804

Ames Lab., Ames, Iowa.

A METHOD FOR REDUCING TIME JITTER IN THE OUTPUT OF A SINGLE CHANNEL ANALYZER. G. W. Eakins, B. J. Loupee, W. A. Rhinehart, G. Schupp, and E. N. Jensen. Dec. 14, 1956. 18p. Contract W-7405-eng-82. $0.20(OTS).

An adapter for single channel analyzers has been built which reduces the time jitter in the output of an analyzer by a factor of approximately six. This reduction enables coincidence studies to be conducted using a correspondingly smaller 2τ which results in an approximate sixfold increase in the true to accidental coincidence ratio. In addition the use of a smaller 2τ permits the measurement of significantly shorter half lives of metastable states than is possible without the use of adapters when only a simple coincidence circuit is utilized. (auth)

4543 NDA-2015-92

Nuclear Development Corp. of America, White Plains, N. Y.

ADDITION OF INELASTIC SCATTERING TO THE UNIVAC MOMENT CALCULATIONS. J. Certaine and J. Brooks. Dec. 17, 1956. 15p. Contract AT(30-1)-862. $0.20(OTS).

4544 ORNL-2234

Oak Ridge National Lab., Tenn.

INSTRUMENTATION AND CONTROLS DIVISION SEMI-ANNUAL PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1956. Feb. 25, 1957. 28p. Contract W-7405-eng-26. $0.25(OTS).

Diagrams of the HRT instrumentation system are given, and the characteristics of various controls are discussed. The circuitry and performance characteristics of a specially designed automatically recording analytical balance are presented. The design and performance of a self-heating resistance thermometer temperature controller are discussed. Quality control of Purex $UO_2(NO_3)_2-HNO_3$ solutions was obtained through in-line instrumentation of solution density and conductance. This instrumentation is described. Recent developments in the ORNL decade scaler are reported. The use of ferrite cores in memory devices is discussed, specific applications are cited, and the development of a tester for determining the uniformity of electrical properties of cores is reported. The circuitry for a mercury relay pulse generator is presented. The

design of a mobile air monitor for use in critical locations where long-period continuous operation are required is reported. (For preceding period see ORNL-2067.) (D.E.B.)

4545 WAL-372/19

Comstock and Wescott, Inc., Cambridge, Mass.

EVALUATION OF HOT HARDNESS MEASURING TECHNIQUES AND THE DEVELOPMENT OF A HOT MICRO-HARDNESS TESTER. Final Report. L. F. Whitney, G. W. Webb, and R. A. Gulick. Oct. 20, 1954. 105p. DA Project 593-08-024. Contract DA-19-020-ORD-439. (AD-82260).

A study was made of all known hardness measuring methods, the techniques that have been employed for micro-hardness testing and for hot hardness testing. Although no suitable apparatus was found, it was concluded after extended preliminary experiments had answered certain critical questions that a micro-hardness tester could be built that would operate at 1250°F and would permit an indentation to be made located with nearly the same degree of accuracy as at room temperature. A special model Tukon tester was equipped with a suitable temperature-controlled furnace, mechanical stage, atmosphere purifying equipment, measuring microscope and other adjuncts to accomplish the purpose. A Knoop diamond indenter and a hydrogen atmosphere were employed. (auth)

4546

ON A HEAVY WATER ELECTROLYZER FOR THE PRODUCTION OF DEUTERIUM FOR USE IN ACCELERATORS. Alexandre Reznik, Guy Laforgerie, and Guy Dupré. Compt. rend. 244, 760-2(1957) Feb. 4. (In French)

A study was made of an electrolyzer whose principle is that of an electrolytic resistance varying as a function of the quantity and yield of the required gas. (tr-auth)

4547

A HIGH-SPEED COMPUTER FOR PREDICTING RADIOACTIVE FALLOUT. J. H. Wright, L. Taback, and H. K. Skramstad. J. Research Natl. Bur. Standards 58, 101-9 (1957) Feb.

A very high-speed analog computer has been developed for predicting the geographic pattern of radioactive fallout that will occur following a nuclear-weapon explosion. Input data consist of wind magnitudes and directions as functions of initial height in the cloud, and the distribution of radioactivity in the cloud as a function of the particle size (in terms of settling rate) and initial height in the cloud. Output data are presented on a cathode ray tube, so that the luminance at any point on the screen represents the intensity of fallout accumulated at that point. (auth)

4548

CONTINUOUSLY INDICATING PRECISION MAGNETOMETER. G. W. Green, R. C. Hanna, and S. Waring (Atomic Energy Research Establishment, Harwell, Didcot, Berkshire, Eng.). Rev. Sci. Instr. 28, 4-8(1957) Jan.

A flat coil is suspended in a magnetic field so that in equilibrium it is coplanar with the field and can oscillate about an axis in the plane of the coil perpendicular to the field. When an alternating current is passed through the coil the system behaves as an inductance in series with a condenser of capacity inversely proportional to the square of the magnetic field. The principle has been applied to the measurement of magnetic field. The instrument is capable of a precision of one part in 10^2 with simple auxiliary apparatus. The application to a particle analyzing magnet is described. With some elaboration the magnetic field can be measured and stabilized to one part in 10^4 in the range 1 to 12 kilogauss. (auth)

4549

FABRICATION OF HOLES OF ABOUT 1 μ IN DIAMETER USED FOR PRODUCING α -PARTICLE MICROBEAMS. Marguerite I. Davis and C. L. Smith (Univ. of Cambridge, Eng.) and P. C. Smethurst (Smethurst High-Light Ltd., Bolton, Lancs). J. Sci. Instr. 34, 32-3(1957) Jan.

In order to produce α-particle beams 1 to $1\frac{1}{2}$ μ in diameter, collimating holes about 1 μ in diameter are needed. These are obtained by reducing 6 μ apertures in Cu disks to 1 μ by evaporating metal on the disks in vacuum. Tin was found to be most satisfactory for this purpose. Diagrams of the evaporating apparatus are included. (B.J.H.)

4550

AN OPTICAL APPARATUS TO MEASURE SHRINKAGE AT HIGH TEMPERATURE. J. Hutchings and J. P. Roberts (Royal Aircraft Establishment, Farnborough, Hants). J. Sci. Instr. 34, 34(1957) Jan.

Descriptions are given of an apparatus which was developed for the continuous measurement of shrinkage occurring during sintering of powder pressings. (B.J.H.)

4551

DEVICE FOR CUTTING A METAL SINGLE CRYSTAL TO EXACT ORIENTATION. H. Sato, J. Getsko, Jr., and W. E. Hickman (Westinghouse Research Labs., Pittsburgh). Rev. Sci. Instr. 28, 58-9(1957) Jan.

ISOTOPES

4552 AERE-C/R-349

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PRODUCTION OF I^{131} FROM TELLURIUM IN GLEEP. A. W. Kenny and W. T. Spragg. Apr. 1949. Decl. Dec. 20, 1956. 22p.

A method is described for the routine production in two working days of carrier-free I^{131} from Gleep-irradiated tellurium: it is suitable also for processing more active targets. The method is a modification of one described in the literature, but the modification increases the yield by about 30% and gives a chemically pure product. The overall yield is better than 90%. (auth)

4553 AERE-RP/M-58

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

COMPOSITION OF RECYCLED FISSILE MATERIALS. F. W. Fenning. Jan. 14, 1955. Decl. Dec. 20, 1956. 4p.

The re-irradiation compositions of radiation produced Pu and U^{233} are given and discussed. (T.R.H.)

4554 TPI-68

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

MATHEMATICAL RELATIONS GOVERNING ISOTOPE PRODUCTION BY NEUTRON IRRADIATION. T. D. Newton. Sept. 1953. 25p. (AECL-359).

4555

ISOTOPES. Joseph Silverman (Radiation Applications Inc., New York) and Karl Cohen (General Electric Co., San Jose, Calif.). Ann. Rev. Phys. Chem. 7, 335-58(1956).

A review of the subject of isotopes in physical chemistry is presented. The subjects included are: Instruments and Methods; Atomic Mass Measurements; Relative Abundance and Isotope Geochemistry; Isotope Separation; Isotope Effects in Equilibrium Phenomena; Chemical Kinetics; and Mass Spectra. (T.R.H.)

4556

EVIDENCE FOR A NEW NEUTRON DEFICIENT ISOTOPE OF SELENIUM. Jacqueline Beydon, Henriette Faraggi, Irene Gratot and Marguerite Le Pape. Compt. rend. 244, 586-9(1957) Jan. 28. (In French)

In the transmutation of Cu by N, the formation of a new light isotope of Se, was verified. It has a period of 5 ± 2 min, emits a β, has a γ ray at about 160 kev, and has a mass of 71, although a mass of 69 is not excluded. (tr-auth)

4557

POSSIBLE EXISTENCE OF Cm^{247} OR ITS DAUGHTERS IN NATURE. H. Diamond, A. M. Friedman, J. E. Gindler, and P. R. Fields (Argonne National Lab., Lemont, Ill.). Phys. Rev. 105, 679-80(1957) Jan. 15.

The absence of any detectable Pu^{243} daughter activity in a sample of curium containing two micrograms of Cm^{247} indicates that the alpha half life of Cm^{247} exceeds 4×10^7 years and probably exceeds 9×10^7 years. The possibilities of finding Cm^{247} in nature and of finding high U^{235}:U^{238} ratios in very old rare-earth minerals are discussed. (auth)

ISOTOPE SEPARATION

4558 RM-1801(RAND)

RAND Corp., Santa Monica, Calif.

A LINEAR PROGRAMMING MODEL OF THE GASEOUS DIFFUSION ISOTOPE-SEPARATION PROCESS. D. M. Fort. Oct. 1, 1956. 77p.

It is shown how the gaseous diffusion process, as applied to the separation of uranium isotopes, may be analyzed in terms of a linear programming model. The gaseous diffusion process involves many "separation elements" arranged in a cascade, with external streams of isotope mixtures of various compositions entering and leaving the cascade at various points. The compositions and flow rates of the various streams are subject to certain well known material balance and separation capacity constraints and to boundary conditions arising from the uni-directional flows within the individual separation elements: it is not permissible to consider external streams that imply reverse flows. In cases involving five or more external streams, the boundary conditions are not automatically met by all sets of relevant streams. The boundary conditions are derived together with the circumstances under which these conditions need to be explicitly applied. It is shown that by a suitable choice of variables a linear programming model of the separation cascade can be set up that incorporates these boundary conditions as well as the material balance and separation capacity constraints. The model may be incorporated in larger models involving other elements such as nuclear reactor and chemical processing facilities. The equations employed in the present model are those for an "ideal cascade" in steady state operation, which implies that for any given set of external streams, the internal operation of the cascade has been arranged to minimize the required separation capacity and associated resources. For any given set of external streams, no degrees of freedom available relate to the various alternative sets of external streams that may be considered. (auth)

MASS SPECTROGRAPHY

4559

METASTABLE TRANSITIONS AND COLLISION-INDUCED DISSOCIATIONS IN MASS SPECTRA. H. M. Rosenstock and C. E. Melton (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 26, 314-22(1957) Feb.

A number of new metastable transitions have been identified in the mass spectra of n-butane and i-butane. The appearance of various metastable transitions was discussed in terms of the quasi-equilibrium theory of mass spectra and the energetics of ionic decomposition processes. A study of the pressure independence of metastable transitions revealed the existence of several collision-induced dissociations. Some similarities of these processes to electron impact-induced dissociations were pointed out. Approximate relative cross sections were determined for the various collision processes. (auth)

MATHEMATICS

4560 AECU-3404

Carbide and Carbon Chemicals Corp. [K-25 Plant,] Oak Ridge, Tenn.

STATISTICAL METHODS. Cuthbert C. Hurd. 1948. 87p. Contract [W-7405-eng-26]. (KZ-1524). $13.80(ph OTS); $4.80(mf OTS).

The notes used as the basis for a series of lectures on statistical methods are presented. Discussions are included on topics such as the fundamentals of statistics, point estimates of normal population parameters, confidence intervals for normal population parameters, and tests of statistical hypotheses. Problems in these topics are also included. (B.J.H.)

4561 CERN-56-31

European Organization for Nuclear Research, Geneva.

CONTINUOUS GROUPS IN QUANTUM MECHANICS. W. Pauli. Dec. 15, 1956. 34p.

Notes from a series of lectures on the Lie algebra of continuous groups are presented. (D.E.B.)

4562 CF-56-1-63

Oak Ridge National Lab., Tenn.

ORACLE CODE FOR EVALUATING BESSEL FUNCTIONS. M. K. Hullings. Jan. 10, 1956. 17p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

An ORACLE code for computing Bessel functions, I_0, I_1, J_0, J_1, K_0, and K_1, has been written as a subroutine. The code is valid for arguments between 0.02 and 50.0 for I_0 and I_1, between 0.02 and 15.0 for J_0 and J_1, and between 1.00 and 50.0 for K_0 and K_1. It is designed for utilization in problems written in ORACLE floating-point code. The working formulas, code, and its operation are presented. (auth)

4563 NYO-7694

New York Univ., New York. Atomic Energy Commission Computing Facility.

ON THE FORMULATION AND ANALYSIS OF NUMERICAL METHODS FOR TIME DEPENDENT TRANSPORT EQUATIONS. Herbert B. Keller and Burton Wendroff. Dec. 31, 1956. 38p. Contract AT(30-1)-1480. $6.30(ph OTS); $3.00(mf OTS).

A class of methods for the numerical integration of the time dependent, one velocity transport equation in spherical geometry is presented. All of the methods proceed by differencing first in the angular variable. The resulting differential-difference equations form a hyperbolic system which, by proper centering, is in a well known normal form. These equations are then transformed into two systems of integral equations from which the final difference equations are obtained. An iterative procedure for solving one of the systems of difference equations is shown to converge under stated conditions on the mesh spacing. The difference scheme for the hyperbolic system is shown to be unconditionally stable and convergent. Assuming that the solution of this hyperbolic system converges, with refinement of the angular mesh, to the solution of the transport equation, a sufficient condition is obtained for convergence of the numerical solution to the transport solution. The methods and analysis presented are easily extended to many-velocity and plane geometry problems. Steady state problems may be treated by introducing obvious simplifications. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

4564 AERE-C/M-39

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A COMPARISON OF OPERATING CHARACTERISTICS OF A GRIDDED AIR-CHAMBER AND A METHANE PROPORTIONAL COUNTER FOR ROUTINE α-COUNTING. K. D. B. Johnson. Oct. 5, 1949. 5p.

For the routine estimation of Pu by α counting after coprecipitation on lanthanum fluoride it is found that the methane proportional counter is a more suitable instrument than a gridded air chamber. The best operating conditions have been found for the methane counter, and factors which may affect the count have been studied. (auth)

4565 AERE-C/R-881

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

AN IMPROVED α-ELECTROSCOPE. PART II. (A) SELF-ABSORPTION. (B) THE DESIGN OF AN ELECTROSCOPE FOR LIQUID SOURCES. C. J. Mandleberg and R. P. Henderson. June 6, 1952. Decl. Nov. 26, 1956. Includes Appendix I. A MATHEMATICAL TREATMENT OF SELF-ABSORPTION. J. Howlett and W. J. Whitehouse. 22p.

The phenomenon of self-absorption is discussed at length, together with methods for making a correction for the error it introduces when comparing sources with an α electroscope. However, an inaccuracy is always introduced because a solid source is never perfectly uniform; this can be overcome by using solutions as sources, and an electroscope for directly comparing plutonium solutions of strengths between 0.1 and 10.0 gms Pu/liter is described, and the possibility of extending this to include solutions containing up to 60 gms Pu/liter is discussed. (auth)

4566 AERE-H/R-193

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE USE OF AN IMMERSION COUNTER FOR ESTIMATING β AND γ ACTIVITY IN SOLUTIONS. G. N. Walton and D. W. Thom. May 6, 1948. Decl. Dec. 20, 1956. 26p.

Results are recorded for the pulses obtained by using an All-Tools type immersion counter dipped in solutions of known concentration of various radio-elements emitting a range of β and γ ray energies. A linear relationship is established between the count from an effectively infinite thickness of solution and the external absorption half-thickness of the β activity measured. From this relationship an absolute calibration factor for the counter is calculated. The specific activity counted from an infinitely thin layer of liquid surrounding the counter is shown, after correction for absorption in the glass window, to be approximately constant for the β active elements measured, in solutions containing equal numbers of disintegrations per ml. From this relationship an absolute calibration factor is calculated which agrees with that obtained from the count from infinite thickness of liquid. The counts due to γ activity from some β and γ active elements are calculated. (auth)

4567 AERE-HP/M-16

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.]

DOSE TO TISSUE FROM RADIO-ELEMENT ON SKIN. A. C. Chamberlain. [nd]. Decl. Dec. 20, 1956. 5p.

Three methods are used to calculate the dose at the base of the stratum corneum due to 1 $\mu c/cm^2$ of a β emitting isotope on the skin. For typical old fission products independent methods give 7.5 and 9.2 rep/hr per μc per cm^2. (auth)

4568 CF-56-11-5

Oak Ridge National Lab., Tenn.

FAST-NEUTRON SPECTROMETER DEVELOPMENT. R. B. Murray. Nov. 2, 1956. 18p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A program for the development of a fast-neutron spectrometer, which would be suitable for the measurement of continuous fission-neutron spectra, is reviewed. Considerable data are included on the neutron detection efficiency of LiI and LiI(Eu) crystals. (B.J.H.)

4569 KAPL-1516

Knolls Atomic Power Lab., Schenectady, N. Y.

RESONANCE-THRESHOLD FOIL NEUTRON PERSONNEL DOSIMETER. J. J. Fitzgerald and C. G. Detwiler. June 8, 1956. 35p. Contract W-31-109-Eng-52. $0.30(OTS).

A resonance-threshold foil neutron personnel dosimeter is described. Some advantages which it offers in personnel monitoring are: (1) A neutron spectrum can be evaluated and an energy corrected total neutron dose can then be determined. (2) Direct thermal and slow neutron dose measurements as low as 25 mrem can be made on a routine basis. (3) It will be possible to interpret, in most cases, the total neutron dose regardless of the relative positions of the source, the body, and the detector. (auth)

4570 NP-6210

Victoreen Instrument Co., Cleveland.

RESEARCH AND DEVELOPMENT OF PHOTOCONDUCTIVE DOSE RATE INDICATOR FOR IONIZING RADIATIONS. Final Progress Report covering Period October 15, 1955, to November 15, 1956. Lewis E. Hollander, Jr. Nov. 30, 1956. 65p. Project No. 3-12-08-031. Contract DA-36-039, SC-70150.

Single crystals of cadmium sulfide were successfully grown, electroded, and processed to yield a photoconductive γ sensitive cell. Difficulties involved in this type of detection such as sensitivity drifts, long rise times, and reproducibility of crystals are discussed. The potentiality of this type of detection and the design development and fabrication of a photoconductive dose rate indicator are also discussed. (C.H.)

4571 POC/Data-19

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.]

SENSITIVITY OF T. P. A. ION CHAMBERS TO SLOW NEUTRONS IN THE HARWELL PILE. D. Norsworthy. June 21, 1950. Decl. Nov. 26, 1956. Includes Appendix I: EFFECT OF CHAMBER PRESSURE ON SENSITIVITY IN A COLLIMATED BEAM. June 20, 1950. 12p.

4572

NEUTRON EXPERIMENTS WITH A SENSITIVE SZILARD-CHALMERS DETECTOR. R. D. Edge (Australian National Univ., Canberra). Australian J. Phys. 9, 429-35(1956) Dec.

The Szilard-Chalmers reaction has been developed as a sensitive detector for the comparison of neutrons from sources of different primary energy and angular distribution. Using sodium permanganate solution, a detection efficiency of approximately 7 per cent for all neutrons in the energy range 0 to 5 Mev was obtained and high accuracy achieved. The method of detection was employed to make the following measurements: 1. The neutron yield from the spontaneous fission of natural uranium was found to be $(1.56 \pm 0.12) \times 10^{-2}$ neutrons sec^{-1} g^{-1}. 2. The cross section for the reaction $Li^6(\gamma,n)$ at 6.2 Mev was found to be $(3 \pm 2) \times 10^{-28}$ cm^2. 3. The cross section for the reaction $Be^9(n, 2n)$ induced by Ra–Be and Po–Be sources of neutrons was found to be $(0.37 \pm 0.06) \times 10^{-24}$ cm^2. 4. A limit

was placed on the cross-over transition from the 2.5-Mev state to the ground state in Co^{60}. The transition probability was found to be less than 1×10^{-6} of that for the cascade consisting of the two γ rays. (auth)

4573

CHEMICAL ASPECTS OF THE GEIGER-MÜLLER DISCHARGE. II. THE 2-PROPANOL—ARGON COUNTER. Robert W. Kiser and W. H. Johnston (Purdue Univ., Lafayette, Ind.). J. Am. Chem. Soc. 79, 811-13(1957) Feb. 20

The decomposition of 2-propanol quench gas by the Geiger-Müller discharge in an argon counter was investigated mass spectrometrically. Decomposition is essentially first order with a decomposition constant of 2.63×10^{-9} per pulse. The stoichiometry for the observed decomposition of 2-propanol may be approximated by $14CH_3CH(OH)CH_3 = 9CH_3CH_2OH + 8CH_3CHCH_2 + 5H_2O$. The primary mechanism of decomposition is attributed to electron impact in the gas phase. The specific electron yield is determined for 2-propanol and compared with the previously studied case of ethanol. (auth)

4574

STANDARD IONIZATION-CHAMBER REQUIREMENTS FOR 250- TO 500-KILOVOLT X-RAYS. H. O. Wyckoff and F. S. Kirn. J. Research Natl. Bur. Standards 58, 111-17(1957) Feb.

Information is provided on the correction factor required for the determination of the dose in roentgens of 250- to 500-kilovolt x-rays from measurement with a free-air ionization chamber. Special emphasis is placed on the determination of each of the factors so that an over-all accuracy of 0.5% can be obtained. (auth)

4575

OPERATION OF A DIFFUSION CLOUD CHAMBER WITH 23 ATM. OF DEUTERIUM. A. P. Batson, B. B. Culwick, H. B. Klepp, and L. Riddiford (Univ. of Birmingham, Eng.). J. Sci. Instr. 34, 17-19(1957) Jan.

The successful operation of an 18-in. diameter diffusion cloud chamber filled with deuterium at a pressure of 23 atm. is reported. The importance of the tritium and oxygen content is discussed. An account of the apparatus for the manufacture and transfer of the deuterium is given. (auth)

4576

RADIO ISOTOPE INSTRUMENTATION AND ACCESSORIES. Denis Taylor and A. G. Peacock, eds. London, Scientific Instrument Manufacturers Association of Great Britian Ltd., 1955. 124p.

Some basic information on radioisotope instrumentation is included. Details and illustrations of a number of instruments of British manufacture are given. (B.J.H.)

4577

USE OF FERROUS SULPHATE SOLUTIONS FOR X-RAY DOSIMETRY. Margaret H. Back and N. Miller (The Univ., Edinburgh 8). Nature 179, 321-2(1957) Feb. 9.

4578

PERSONNEL PROTECTION INSTRUMENTS FOR USE IN GAMMA IRRADIATION CELLS. E. W. Pulsford (Atomic Energy Research Establishment, Harwell) and C. C. H. Washtell (Labgear, Cambridge). Nuclear Power 2, No. 10, 58-61(1957) Feb.

The requirement for instruments which will give warning and provide an indication of the hazard of dangerous conditions in irradiation cells is discussed. Circuits are shown for a γ alarm unit and of a portable γ dose-rate monitor. (B.J.H.)

4579

BREMSSTRAHLUNG MEASUREMENTS WITH A COMPTON ELECTRON SPECTROMETER. J. W. Robson and E. C. Grett (Case Inst. of Tech., Cleveland, O.). Phys. Rev. 105, 619-24(1957) Jan. 15.

A method of analyzing the data obtained from a Compton electron spectrometer in order to obtain the incident photon spectrum is described. Practical considerations limit the application of this analysis to photon energies about 5 Mev. Application of this analysis to a measurement of the spectrum of the Case betatron is described. (auth)

4580

THE USE OF MULTIPLE SCATTERING AND THE EFFECTS OF DISTORTION IN A HIGH-PRESSURE CLOUD CHAMBER. P. Baxter and F. R. Stannard (Univ. Coll., London). Proc. Phys. Soc. (London) A70, 17-25(1957) Jan.

Multiple scattering measurements on tracks of high energy ionizing particles in a high-pressure cloud chamber are described, and the use of such measurements for estimating the product, $p\beta$, of momentum and velocity of the particles is discussed. Q-values of Λ^0-decays and the masses of particles stopping in the chamber are deduced from such measurements. The various distortions found in this type of chamber and their effect on multiple scattering measurements are discussed. (auth)

4581

LOW ENERGY GAMMA SCINTILLATION SPECTROMETRY. Chester J. Borkowski (Oak Ridge National Lab., Tenn.). IRE Trans. Nuclear Sci. NS-3, No. 4, 71-6(1956) Nov.

Techniques are reviewed which are used to: obtain good resolution with Scintillation Spectrometers; minimize pulses which fall outside of photo peaks; measure absolute gamma efficiencies of NaI crystals as a function of energy; and measure K/L capture ratios and gamma conversion coefficients. Some factors affecting energy resolution including associated electronic circuits are discussed. (auth)

4582

RESPONSE OF "TOTAL ABSORPTION" SPECTROMETERS TO GAMMA RAYS. R. C. Davis, P. R. Bell, G. G. Kelley, and N. H. Lazar (Oak Ridge National Lab., Tenn.). IRE Trans. Nuclear Sci. NS-3, No. 4, 82-6(1956) Nov.

A single crystal of sodium iodide $9\frac{1}{4}$ inches in diameter and 9 inches high with the top bevelled at 45° was recently obtained from Harshaw Chemical Company. A half-inch hole was drilled in the bevelled end to the center of the crystal. Three 5-inch diameter Dumont 6364's were optically connected directly to the flat end of the crystal. Sources were placed inside the crystal and γ spectra obtained, taking advantage of full geometry. A $4\frac{3}{4}$ inches diameter sodium iodide crystal $5\frac{1}{2}$ inches high with the top bevelled at 45° has a $\frac{1}{4}$ inch hole drilled to the center. The crystal is optically connected to a Dumont 6364. The crystal is placed inside a 28-inch tank of liquid scintillator which uses four Dumont 6364's to detect pulses in the liquid. Samples are placed inside the crystal and the pulses from the crystal and liquid scintillator are placed in anticoincidence to reduce the Compton portion of the γ spectra. Typical spectra with these counters are shown along with a comparison of data taken with these and smaller crystals. (auth)

4583

AN ANALYSIS OF THE BACKGROUND RADIATION DETECTED BY NaI CRYSTALS. C. E. Miller, L. D. Marinelli, R. E. Rowland, and J. E. Rose (Argonne National Lab., Lemont, Ill.). IRE Trans. Nuclear Sci. NS-3, No. 4, 90-6 (1956) Nov.

The 0.07 to 2.5 Mev scintillation pulse height spectra of several NaI crystals, heavily shielded by Fe and Hg, have been analyzed in coincidence and anticoincidence with cosmic ray counters surrounding the crystals. The residual spectra have been analyzed further and the following sources

have been identified: (1) Ra^{226} in Al casing, (2) K^{40} in phototube, crystal, and canning window, and (3) low pulse height spectrum due to the ionizing components of cosmic rays. The above sources still leave 0.05 c/m/g of NaI unexplained. Activities in stainless steel, quartz, and MO reflectors are too low to account for the bulk activity. Moreover, activation analysis of crystal fragments has eliminated the presence of Rb^{87} as a natural contaminant, and decay studies in neutron free caves preclude the presence of I^{126} from cosmic ray neutron activation. A possible source of contamination, consistent with the none too well defined shape of the residual spectrum, is Cs^{137}, a fission product, in weight concentrations of about 5×10^{-16}. Studies aimed at proving or disproving its existence are currently being pursued. (auth)

4584

IN VIVO GAMMA MEASUREMENTS AT VERY LOW LEVELS WITH 4π LIQUID SCINTILLATION DETECTORS. Ernest C. Anderson (Los Alamos Scientific Lab., N. Mex.). IRE Trans. Nuclear Sci. NS-3, No. 4, 96-102(1956) Nov.

A large 4π liquid scintillation counter for the rapid measurement of total internal gamma contamination of the human body at concentrations 1000 times less than the maximum permissible levels is described. A counting time of only 100 seconds per subject is required to obtain a sensitivity of 5×10^{-10} curies for 1.5 mev gamma rays. Because of the high counting efficiency and the great stability of operation, the magnitude of counter background is of comparatively little importance so that elaborate shielding precautions are not required. Energy resolution is sufficient to distinguish between gamma rays of markedly different energy, but not adequate for the identification of individual nuclides. The operating characteristics of the counter are discussed including the spectrum and stability of background, energy resolution, and the spectra and limits of sensitivity for nuclides of interest in connection with nuclear power stations and uranium mining operations. (auth)

4585

IMPROVED TIME RESPONSE IN SCINTILLATION COUNTING. Quentin A. Kerns (Univ. of California, Berkeley). IRE Trans, Nuclear Sci. NS-3, No. 4, 114-20(1956) Nov.

Antiproton observations at the Bevatron are typical of scintillation counting experiments that would benefit by improved time response. The antiproton yield increases as the flight path of the particle is shortened and the corresponding solid angle increased. From the electronics standpoint, the problem of pulse rise time prevents an arbitrary reduction of the flight path. The first limitation appears in the scintillator-photomultiplier combination, the second in the interconnecting cable, and the last in the indicating circuitry, i.e., coincidence devices, scalers, oscilloscopes, amplifiers, etc. In Part I of this paper, transit time data for the RCA type 6810 are presented. These suggest a method for improving tube performance. Figures are given in Part II for pulse distortion in typical coaxial cables. Performance data are given for a low-distortion 125-ohm transmission line. The line, using styrofoam dielectric, is easily made and useful over several hundred feet in the 10^{-10} second range. (auth)

4586

PEAK EFFICIENCY OF NaI(Tl) CRYSTALS FOR GAMMA RAYS FROM 0.150 TO 7.5 MEV. N. H. Lazar, R. C. Davis, and P. R. Bell (Oak Ridge National Lab., Tenn.). IRE Trans. Nuclear Sci. NS-3, No. 4, 136-7(1956) Nov.

The peak efficiencies of cylindrical $1\frac{1}{2} \times 1$-inch, 3×3-inch and 3×3-inch bevelled crystals have been determined by the multiplication of the theoretical total efficiency for a particular energy gamma ray by the experimentally determined ratio of the areas under the full energy peak and under the total pulse height spectrum for the gamma ray. Care was taken to eliminate spurious effects in the pulse height spectrum such as scattering, bremsstrahlung, and other interfering gamma radiation from the source, etc., in the experimental measurements. The peak efficiencies have also been determined at certain energies by $\beta - \gamma$ coincidence experiments and yield the same results within 5 per cent for energies to 2.76 Mev. The intensities of gamma rays determined in this way have been compared to the disintegration rates obtained from 4π β-counting techniques from sources with known decay schemes, and the results agreed within the limits given above. The extension of these efficiencies to crystals of different composition or to crystals with the same shapes but different dimensions will be discussed. (auth)

4587

CALORIMETRIC DETERMINATION OF THE POWER IN A 1400 Kv X-RAY BEAM. John McElhinney, Bernard Zendle, and Steve R. Domen (National Bureau of Standards, Washington). Radiation Research 6, 40–54(1957) Jan.

4588

DISASTER MONITORING WITH AMATEUR PHOTOGRAPHIC FILM AND WITH DENTAL X-RAY FILM. Margarete Ehrlich (National Bureau of Standards, Washington). Radiology 68, 251-4(1957) Feb.

4589

DOSIMETRY OF INTERSTITIAL IMPLANTS. M. L. Meurk, A. Jacobson, and R. J. Schultz (Memorial Center, New York). Radiology 68, 256-7(1956) Feb.

4590

A STABLE, LOW-BACKGROUND, HIGH-EFFICIENCY SCINTILLATION COUNTER FOR ANALYSIS OF LOW LEVELS OF RADON CONCENTRATED BY ADSORPTION ON CHARCOAL. H. F. Lucas, Jr. (Argonne National Lab., Lemont, Ill.). Radiology 68, 258-9(1957) Feb.

4591

AN AUTOMATIC BRAIN SCANNER FOR USE WITH GAMMA-RAY-EMITTING ISOTOPES. W. B. Reid and H. E. Johns. Radiology 68, 259(1957) Feb.

4592

LINE SHAPES AND INTENSITIES FROM DISK SOURCES USED IN AN HOMOGENEOUS MAGNETIC FIELD BETA-RAY SPECTROMETER WITH NEW AND CONVENTIONAL SLIT GEOMETRIES. David B. Beard (Univ. of California, Davis). Rev. Sci. Instr. 28, 19-27(1957) Jan.

This paper is primarily concerned with the effect on the line profile shape and intensity of the angle φ, the angle made by the projection of the electron velocity vector on a plane perpendicular to the instrument axis at the source with the radius of the source point. Quantitative results are quoted for several geometries. The line profile, expected intensity, and optimum source size for a commonly used slit geometry utilizing an entrance slit for take-off angle selection is found to differ significantly from previously quoted results, the intensity for the same half width for optimum source size being 46% of the earlier work. A new slit geometry consisting of an additional baffle near the source which restricts φ is discussed and is found to improve the expected intensity for the same line half width by 24% for an optimized Hubert slit system which is already found in this paper to be 28% better than the best of previous slit geometries. Finally, a geometry which selects φ properly is shown to remove all dependence on source size from the resolution. (auth)

4593

NEUTRON ENERGY MEASUREMENTS WITH DOUBLE PULSE SCINTILLATION COUNTERS. P. T. Andrews

(Victoria Univ. Coll., Wellington, New Zealand). Rev. Sci. Instr. 28, 56(1957) Jan.

Some remarks are made concerning scintillation counters of the type which produce two separate pulses when a neutron enters the phosphor. It is noted that because of the phosphor nonlinearity and the occurrence of neutron-carbon collisions, the height of the first pulse will vary according to the neutron thermalizing process. It is concluded that the double pulse system using an organic phosphor would not give an accurate measurement of the energy of a single fast neutron. (B.J.H.)

Refer also to abstracts 4388 and 4759.

MESONS

4594

ON THE INTERACTION OF NEGATIVE K MESONS AT REST WITH TWO NUCLEONS. Andre Berghelot, Odette Goussu, Francoise Levy, and Livio Scarsi. Compt. rend. 244, 447-50(1957) Jan. 21. (In French)

Two K^- meson interactions were observed which necessitate the simultaneous intervention of two nucleons. A certain number of others were observed in which this intervention seemed extremely probable. (tr-auth)

4595

MASSES OF IDENTIFIED POSITIVE HEAVY MESONS. James Ray Peterson (Univ. of California, Berkeley). Phys. Rev. 105, 693-706(1957) Jan. 15.

The charged secondary particles from all presently known decay modes of positive K mesons have been identified, and the masses of the primaries measured by the momentum-range method. More than 2000 K mesons were found in a rather large stack of nuclear emulsion after its exposure, behind the strong-focusing magnetic spectrometer at the Bevatron, to a target plunged into the 6.2-Bev circulating proton beam. The mean K-meson momentum at the stack was 360 Mev/c, and the proper time of flight was 1.4×10^{-8} sec. The masses of 263 systematically selected K mesons were measured, and the averages for the various decay modes are $M(\tau + \tau') = 966.6 \pm 1.9 m_e$, $M(K_{\pi 2}) = 966.9 \pm 2.0 m_e$, $M(K_{\mu 2}) = 967.2 \pm 2.2 m_e$, $M(K_{\mu 3}) = 969 \pm 5 m_e$, and $M(K_{\beta 3}) = 967 \pm 8 m_e$. The standard errors indicated apply to the relative masses; the uncertainties on the absolute masses are slightly larger. Various corrections are described. The results are discussed in the light of recent ideas concerning heavy-meson characteristics. (auth)

4596

SCATTERING OF 10-30 Mev NEGATIVE PIONS BY HYDROGEN. D. E. Nagle, R. H. Hildebrand, and R. J. Plano (Univ. of Chicago, Ill.). Phys. Rev. 105, 718-24(1957) Jan. 15.

Fifty-seven π^--p scattering events in the energy range 10 to 30 Mev have been observed in a hydrogen bubble chamber. The S-wave scattering length $\frac{1}{3}\eta^{-1}(2\alpha_1 + \alpha_3) = 0.077 \pm 0.011$ is found to give the best fit to the data assuming $\alpha_{13} = \alpha_{31} = \alpha_{11} = 0$, $\alpha_{33} = 0.235\eta^3$. This result is combined with the results of other low-energy scattering experiments to give estimates of α_1 and α_3. (auth)

4597

PION-PROTON SCATTERING AT 220 Mev. J. Ashkin, J. P. Blaser, F. Feiner, and M. O. Stern (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 105, 724-8(1957) Jan. 15.

Pion-proton differential scattering cross sections have been measured at 220 ± 7 Mev. Measurements were made at eight angles using scintillation counters and a liquid hydrogen target. Statistical errors range from 5 to 10%. Phase shift analyses have been made of the data in the customary manner. No evidence for d-wave scattering has been found. (auth)

4598

PION PRODUCTION BY INELASTIC SCATTERING OF ELECTRONS IN HYDROGEN. G. B. Yodh and W. K. H. Panofsky (Stanford Univ., Calif.). Phys. Rev. 105, 731-4 (1957) Jan. 15.

Measurements have been continued on the ratio of single-pion production yield in hydrogen by electrons to the yield by the corresponding photons. At an incident electron energy of 600 Mev, pions were detected at energies of 60, 147, and 170 Mev, emitted at 75° to the beam; and of 70 Mev at 135° to the beam. The results are tabulated in terms of "the equivalent number of photons" N_e. The results are compared with theoretical calculations and found to be in good agreement. (auth)

4599

PRODUCTION OF POSITIVE PIONS IN (p−p) COLLISIONS AT 660 Mev. V. M. Sidorov (Academy of Sciences, USSR) Soviet Phys. JETP 4, 22-30(1957) Feb.

Using nuclear emulsions, the energy spectra of positive pions produced in the reaction $p + p \rightarrow \pi^+ + \{d/p + n\}$ at an energy of 657 ± 8 Mev have been measured at angles, θ_π equal to 60°, 75°, 90°, 105° and 120° in the laboratory system. The angular dependence of the cross section $d\sigma/d\omega(\theta^*)$ in the center-of-mass system of the colliding nucleons and the total cross section for the reactions: $p + p \rightarrow \pi^+ + \{d/p + n\}$ and $p + p \rightarrow p + n + \pi^+$ has been determined. The results are consistent with the assumption that the mesons are produced chiefly in p-states. In addition to transitions to the S-state of the final (n−p) system, it is found that an important contribution is made by transitions in which the final state is a P-state. (auth)

4600

π^+-MESON ENERGY SPECTRUM FOR $pp \rightarrow np\,\pi^+$ REACTION AT 556 AND 657 MEV. M. G. Meshcheriakov, V. P. Zrelov, B. S. Neganov, I. K. Vzorov, and A. F. Shabudin (Academy of Sciences, USSR). Soviet Phys. JETP 4, 60-7 (1957) Feb.

The π^+ spectrum for the reaction $pp \rightarrow np\pi^+$ was studied at bombarding energies of 556 and 657 Mev. By magnetic analysis at an angle of 24° to the proton beam. The ratio of the differential cross section at 45° (measured in the center-of-mass system) for the two energies proved to be $(d\sigma^*/d\omega^*)_{657}$: $(d\sigma^*/d\omega^*)_{556} = 2.2:1$. For both bombardment energies, approximately 80% of the available energy is spent in the formation of the π^+ meson in a single elementary act. A comparison of the measured spectrum with the energy distribution corresponding to the statistical weights of the final states computed under the assumption that the meson is formed directly indicated that in the low energy part of the spectrum the matrix element associated with the initial and final state for the reaction varies linearly with meson momentum and has approximately the same value at identical momenta for both bombarding energies. (auth)

4601

THE PRODUCTION OF CHARGED MESONS BY THE BOMBARDMENT OF BERYLLIUM AND CARBON WITH 660 MEV PROTONS. M. G. Meshcheriakov, I. K. Vzorov, V. P. Zrelov, B. S. Neganov, and A. F. Shabudin (Academy of Sciences, USSR). Soviet Phys. JETP 4, 79-85(1957) Feb.

The energy spectra of positive and negative pions released in p + Be and p + C collisions was measured with a magnetic spectrometer at an angle 24° to a 660-Mev proton beam. The π^+ meson spectrum has a clearly defined maximum at an energy of about 210 Mev in the laboratory system, whereas the spectrum for the π^- mesons varied only slightly over a range from 60 to 250 Mev. The probability of positive

pion formation when protons collide with protons bound in Be and C nuclei was discovered to be at least three times less than where protons act on free protons. The maximum of the π^+ meson spectrum in the center-of-mass coordinate system is situated near 100 Mev. The ratio of positive to negative pion emission was determined for Be and C over the whole spectral range. The ratio of total emission of positive to negative pions for these two elements is equal, respectively, to 5.3 ± 0.6 and 7.0 ± 0.8. (auth)

4602
ON THE THEORIES OF MULTIPLE MESON PRODUCTION. L. G. Iakovlev (Moscow State Univ.). Soviet Phys. JETP 4, 141-3(1957) Feb.

Refer also to abstracts 4616 and 4737.

MICROWAVES

4603 AEC-tr-2821
TRANSMISSION OF CENTIMETRIC WAVES ON WIRE-LIKE WAVEGUIDES. (Transmission d'ondes Onetimetriques sur Guides d'ondes filiformes). P. Chavance and B. Chiron. Translated from Ann. Telecomm. 8, 373-6 (1953). 5p.

MOLECULAR PROPERTIES

4604
EXPERIMENTAL MOLECULAR STRUCTURE. San-ichiro Mizushima and Takehiko Shimanouchi (Tokyo Univ., Japan). Ann. Rev. Phys. Chem. 7, 445-64(1956).

Bond length, bond angle, the equilibrium angle of internal rotation, and the transferability of force constants are reviewed. (T.R.H.)

4605
ZEEMAN EFFECT ON THE QUADRUPOLE SPECTRUM OF IODIC ACID. Ralph Livingston and Henry Zeldes (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 26, 351-8(1957) Feb.

The pure quadrupole spectrum of I^{127} in iodic acid has been observed at several temperatures. At 22°C the z component of the quadrupole coupling is 1126.9 Mc and η, the asymmetry parameter is 0.4505. Zeeman studies on the low frequency transition ($\pm \frac{1}{2} - \pm \frac{3}{2}$) showed an intensity effect that depended on the orientation of the crystal in the rf coil. Extra Zeeman components were present that resulted from a proton interaction, and the study of these essentially located the hydrogen in the crystal lattice. Zeeman studies on the high frequency transition ($\pm \frac{3}{2} \rightarrow \pm \frac{5}{2}$) showed four components for each type of iodine atom, the two not normally present unless η is large were weak. The splittings of the levels were uniquely assigned and the directions of the principal axes computed. (auth)

NEUTRONS

4606 AERE-M/M-80
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
MANUFACTURE OF A PLUTONIUM–BERYLLIUM NEUTRON SOURCE. J. Sheldon and J. Williams. Aug. 19, 1954. Decl. Dec. 20, 1956. 3p.

The preparation of a $PuBe_{13}$ neutron source by powder techniques is described. Incomplete homogenization is believed to be responsible for the flux being lower than anticipated at $\sim 10^5$ neutrons/sec. (auth)

4607 AERE-M/M-138
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE MEASUREMENT OF FAST NEUTRON FLUX FOR IRRADIATION DAMAGE STUDIES. D. G. Martin and P. R. Stanwix. Nov. 20, 1956. 6p.

A routine method for measuring integrated fast neutron doses is described. Its basis is that the $S^{32}(n,p)P^{32}$ reaction occurs only for neutrons of energies greater than 1 Mev. It is possible therefore to calculate the fast neutron flux above this energy level by measuring the activity of P^{32} formed by irradiating sulfur. This method should be suitable for use in conjunction with irradiation damage studies. (auth)

4608 AERE-R/M-96
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE DESIGN OF A SLOWING DOWN EXPERIMENT. W. G. Davey. Oct. 1956. 9p. (LMFS/N-4).

The minimum size of bismuth–graphite lattice necessary to determine the neutron slowing down area in the lattice to within 1% accuracy is considered. (B.J.H.)

4609
AN UNSYMMETRIC OPERATOR ARISING IN THE THEORY OF NEUTRON DIFFUSION. Joseph Lehner (Los Alamos Scientific Lab., N. Mex.). Commun. on Pure and Appl. Math. 9, 487-97(1956) August.

4610
INELASTIC SCATTERING OF NEUTRONS BY PARAMAGNETIC MEDIA. Pierre-Gilles de Gennes. Compt. rend. 244, 752-5(1957) Feb. 4. (In French)

The energy spectrum of neutrons scattered by a paramagnetic substance where exchange interactions exist is calculated in the high-temperature limit. (tr-auth)

4611
ON GREEN FUNCTION IN KINETIC EQUATION OF NEUTRONS. Khr. Ya. Khristov. Doklady Akad. Nauk S.S.S.R. 111, 981-4(1956) Dec. 11. (In Russian).

Equations were developed for a variety of possible neutron processes. These equations can be applied in the cases when the scattering occurs by nuclei with the mass number not much larger than that of the neutron, and to estimate the nuclear fission induced by the thermal, fast, and intermediate neutrons. The following elementary processes were analyzed: the radioactive decay; the neutron scattering in the collision with the particles in the medium, (e.g., nuclei); the absorption of neutrons by nuclei of the medium followed by the emission of radioactive nuclei capable of producing delayed neutrons; the neutron absorption followed by the formation of radioactive nuclei producing delayed neutrons and emitting one or several neutrons; and the continuous changes in the neutron velocity between two examples of 1 to 4 type. (R.V.J.)

NUCLEAR PHYSICS

4612 AERE-T/R-962
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A COMPARISON BETWEEN HOMOGENEOUS MEDIA AND LATTICE STRUCTURES FOR SYSTEMS WHERE CRITICALITY WOULD BE GOVERNED BY FAST FISSION. M. Biram. Aug. 1952. Decl. Nov. 26, 1956. 27p.

An infinite lattice of pure fissile units embedded in some packing material is considered, under the assumptions that the criticality is governed by fast fission, that the mean free paths in the fissile and the packing material are the same, and there are no air gaps between the fissile and the packing materials. The analysis is carried out on the transport theory basis. The relation between the nuclear constants, the size of the fissile units and the lattice pitch which would make the infinite lattice just critical was determined for three cases: 3-dimensional lattice of

spherical lumps, 2-dimensional lattice of cylindrical rods, and a one-dimensional sequence of flat sheets. It is shown that the interaction between the units can be safely evaluated on the diffusion approximation. The numerical results include the case of Pu rods of 0.068 m.f.p. radius packed in cast Fe and it is shown for this case that the amount of Pu one can store in this manner per given amount of Fe is 23% less than would be the case for a homogeneous mixture of Fe and Pu. (auth)

4613 CRT-679

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE INTERACTION OF A NUCLEON WITH THE NUCLEUS. Erich Vogt and Jean Lascoux. Jan. 1957. 49p.

The role played by nucleon-nucleon correlations and the Pauli principle in establishing the validity of the shell model is studied. It is shown that the second moment of the strength function can be an important measure of the extent to which a wave function solves the Schroedinger equation for the whole nucleus. A set of wave functions is defined which describe one nucleon at a time behaving as an independent particle while the motions of the other nucleons as well as the correlations of these motions with the motion of the first nucleon are treated exactly. The second moment is calculated from these wave functions by a method which considers only pairs of nucleons in strong interaction neglecting effects due to the interaction of three or more nucleons at a time. When the correlations between the independently moving nucleon and the other nucleons are ignored, the second moment is shown to depend strongly on the form of the two-nucleon potential—particularly when this potential contains strong repulsion at small distances. It is shown that, however large the second moment without correlations may be, the nucleon-nucleon correlations combined with the Pauli principle reduce it to a small value—less than $(10\ \text{Mev})^2$. The corresponding wave functions are, in certain cases, fairly good approximate solutions of the Schroedinger equation. The role played by the nucleon-nucleon correlations and the Pauli principle in reducing the second moment is explained. (auth)

4614 NP-6197

Naval Research Lab., Washington, D. C.

NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period October–December 1956. Jan. 1, 1957. 42p.

Theory and design of a two meter electrostatic analyzer are presented. The analyzer was used to determine resonances in the Al^{27} (p,γ) Si^{28} reaction and the threshold for Li^7(p,n) Be^7. The modes of decay of 158 charged Σ hyperons found in 1001 K stars are listed. The Weyl form of the free-particle Dirac equations are modified to define a three-dimensional manfold of generalized plane-wave representations of a free spin-$\frac{1}{2}$ particle. New values are given for the photoneutron thresholds of Rb^{85} and Rb^{87}. Radiation induced formation of NH_3 was observed for two irradiation conditions; pure gaseous mixtures and saturated aqueous solutions of N_2 and H_2. Results are tabulated. Corrosion rates of bare and Ni-plated carbon steel in 600°F H_2O were determined by the H_2 effusion technique. The data indicate a high initial corrosion rate which is followed by a very low rate promoted by the formation of a protective film. The emission spectra of unirradiated and γ-irradiated naphthalene are compared. A reproducible method of preparing Mn-activated CaF_2 is outlined. Performance tests establish this material as a promising radiation dosimeter. (For preceding period see NP-6142.) (D.E.B.)

4615 UCRL-3593

California. Univ., Berkeley. Radiation Lab.

PHYSICS DIVISION QUARTERLY REPORT [FOR] AUGUST, SEPTEMBER, OCTOBER 1956. Nov. 20, 1956. 44p. Contract W-7405-eng-48. $0.30(OTS).

Research with the liquid H bubble chambers is reviewed. Mass values are reported for the K^- meson and the Σ^- hyperons. Cross sections for antiproton interactions in various elements are listed. An optical-model analysis of nuclear absorption cross sections for 4.2-Bev π^- mesons is given. An example of a positive $K_{\mu 2}$ meson from an antiproton annihilation star is described. A swivel vacuum seal for the 60-in. cyclotron is described. (For preceding period see UCRL-3524.) (B.J.H.)

4616 UCRL-3604

California. Univ., Berkeley. Radiation Lab.

ON COMMUTATION RELATIONS OF INTERACTING SPINOR FIELDS AND THE SCATTERING AND PRODUCTION OF K MESONS (thesis). Richard Spitzer. Nov. 26, 1956. 89p. Contract W-7405-eng-48. $13.80(ph OTS); $4.80(mf OTS).

It is shown that the requirement that the Hamiltonian density commute with itself on a spacelike surface precludes the possibility that three or more different spinor fields, coupled to one another in Yukawa-type interactions, commute with one another. If the Hamiltonian contains only two such fields, however, they may be assumed to either commute or anticommute without violating this requirement. The cross sections for scattering of K^+ mesons by nucleons and for the production of K mesons in association with heavy fermions are discussed on the basis of weak coupling theories. The predictions of lowest-order perturbation theory are presented and compared with experimental results. (auth)

4617

CLASSICAL MODEL OF K CAPTURE INNER BREMSSTRAHLUNG. Rolf G. Winter (Pennsylvania State Univ., University Park). Am. J. Phys. 25, 79-80(1957) Feb.

As a classical model for radiative capture, a current loop that has initially a moment of one Bohr magneton and that decays with a mean life of ħ divided by the transition energy is considered. The shape of the low energy end of the spectrum and the total number of photons produced per capture are given correctly. (auth)

4618

A MODEL OF NUCLEAR SHAPE OSCILLATIONS FOR γ-TRANSITIONS AND ELECTRON EXCITATION. L. J. Tassie (Univ. of Melbourne). Australian J. Phys. 9, 407-18(1956) Dec.

A model of nuclear shape oscillations is set up for an arbitrary nuclear charge distribution. For a uniform charge distribution the model reduces to the liquid drop model. The model is used to consider γ transitions and electron excitation of nuclei. Explicit expressions are obtained for four charge distributions: (a) uniform, (b) Gaussian, (c) exponential, (d) uniform with Gaussian "edge." The theory predicts a relative angular distribution of electrons scattered by the 4.43-Mev level of C^{12} in agreement with the experimental results of Fregeau and Hofstadter (1955), but gives a scattered intensity seven times too large. (auth)

4619

ALPHA-DECAY HINDRANCE-FACTOR CALCULATIONS. Charles J. Gallagher, Jr. and John O. Rasmussen (Univ. of California, Berkeley). J. Inorg. and Nuclear Chem. 3, 33-44(1957) Jan.

The hindrance factor, F, in alpha decay is defined in terms of constants A and B which are empirically determined for each element. The determination of A and B by fitting even-

even alpha-decay rates is discussed. Using these values, hindrance factors for all known alpha groups of alpha emitters with greater than 128 neutrons and 83 protons have been calculated. The results are divided into four groups corresponding to odd-odd, odd-even, even-odd, and excited states of even-even alpha emitters. Hindrance factor distributions are presented in histogram form. (auth)

4620

NONMESONIC DECAY OF A He^4 HYPERFRAGMENT. A. G. Barkow and B. Chamany (Marquette Univ., Milwaukee, Wisc.). Phys. Rev. 105, 692-3(1957) Jan. 15.

A He^4 hyperfragment is observed in a cosmic-ray star. The disintegration is nonmesonic and results in the collinear production of a triton and proton. The binding of the Λ^0 particle was measured and found to be 4.3 ± 1.6 Mev. (auth)

4621

EVALUATION OF CASCADE ANGULAR AND RADIAL DISTRIBUTIONS FROM THEIR MOMENTS. B. A. Chartres (The Univ. of Sidney, Australia). Phys. Rev. 105, 707-13 (1957) Jan. 15.

The amount of information contained in the moments of the angular and radial distribution functions of an electron-photon cascade is investigated. Methods of reconstructing the distribution functions from their moments are analyzed. It is shown that under the Landau approximation the moments determine accurately the angular distribution for all values of $E\theta/E_s$ greater than 0.5, and the radial distribution for all values of Er/E_s greater than 3. (auth)

4622

SEARCH FOR ANTIPROTONS. Donald H. Stork, Robert W. Birge, Roy P. Haddock, Leroy T. Kerth, Jack Sandweiss, and Marian N. Whitehead (Univ. of California, Berkeley). Phys. Rev. 105, 729-30(1957) Jan. 15.

Two examples of antiproton annihilation have been observed in an emulsion stack exposed at the Bevatron. The experimental arrangement was designed to effect a partial separation of antiproton and pion fluxes. From the yield of antiprotons, the total cross section for antiprotons in beryllium is estimated to be $(1^{+0.2}_{-0.1})$ barn. The average energy of the antiprotons in the beryllium was 315 Mev. (auth)

4623

ON THE USE OF THE COMPLETE INTERACTION HAMILTONIAN IN ATOMIC REARRANGEMENT COLLISIONS. J. D. Jackson (McGill Univ., Montreal, Can.). Proc. Phys. Soc. (London) A70, 26-33(1957) Jan.

The use of the complete interaction Hamiltonian in the problem of the transfer of an electron from a hydrogen-like target atom with nuclear charge Ze to an incident ion of charge Z'e is discussed both qualitatively and quantitatively. The second Born approximation is examined in detail, and it is shown that for $Z' = Z = 1$ the second Born approximation correction to the matrix element very nearly vanishes when the complete interaction Hamiltonian is employed. This gives a theoretical explanation for the good agreement between theory and experiment for electron capture by protons in hydrogen even at incident velocities such that $h\nu/e^2 \sim 1$, and the poor agreement for alpha particles in hydrogen in the same velocity range. (auth)

4624

THE STRIPPING THEORY OF DEUTERON REACTIONS AND THE INELASTIC SCATTERING OF DEUTERONS. W. M. Fairbairn (Univ. of Glasgow). Proc. Roy. Soc. (London) A238, 448-72(1957) Jan. 29.

The wave functions for the deuteron stripping process are constructed in a concise form, using the approximations of Butler. The resulting theoretical cross-section for (d,p) reactions is determined in terms of the nuclear constants, namely, the reduced widths and the logarithmic derivatives of the target nucleus. The interaction between the neutron and the proton after the stripping has taken place is introduced, and it is shown that the inelastic scattering of deuterons is then predicted. Using the zero-range approximation for the neutron-proton interaction the differential cross-section for (d,d') reactions is obtained. However, the formula is complicated and unsuitable for comparison with experimental results. An approximate expression is derived for the cross-section and comparison is made with the data available on the $Mg^{29}(d,d')\,Mg^{24*}$ reaction, but it seems improbable that (d,d') reactions will prove to be useful for determining spins and parities of nuclear levels. (auth)

4625

EFFECT OF A REPULSIVE CORE IN THE THEORY OF COMPLEX NUCLEI. H. B. Bethe and J. Goldstone (Univ. of Cambridge). Proc. Roy. Soc. (London) A238, 551-66 (1957) Jan. 29.

Using Brueckner's method for the treatment of complex nuclei, the effect of an infinite repulsive core in the interaction between nucleons is studied. The Pauli principle is taken into account from the beginning. A spatial wave function for two nucleons is defined, and an integro-differential equation for this function is derived. Owing to the Pauli principle, the wave function contains no outgoing spherical waves. A solution is given for the case when only a repulsive core potential acts. The effective-mass approximation is investigated for virtual states of very large momentum. (auth)

4626

THE EFFECT OF P-STATE AND HIGHER ANGULAR MOMENTUM HARD-CORE INTERACTION ON NUCLEAR BINDING. D. J. Thouless (Univ. of Cambridge). Proc. Roy. Soc. (London) A239, 108-12(1957) Feb.

Brueckner's method for the study of complex nuclei is used to examine the effect of a hard-core interaction between nucleons with non-zero relative angular momentum. The P-state interaction is found to have a considerable influence on binding, and is liable to reduce the calculated stable nuclear density. Higher angular momenta should have only a small influence. (auth)

4627

CASCADE SHOWERS PRODUCED BY ELECTRONS AND PHOTONS IN LIGHT AND HEAVY ELEMENTS. I. P. Ivanenko (Moscow State Univ.). Soviet Phys. JETP 4, 115-30(1957) Feb.

A regular method is given for plotting cascade curves from known moments. The cascade curves in light elements for primary electrons and photons with an energy E_0 are computed (E_0 is of the order of the critical energy for the given substance). A recursion formula is deduced which permits the calculation of all cascade curve moments with scattering and ionization losses and the dependence of the total photon absorption coefficient $\sigma(E)$ on energy for an arbitrary primary particle spectrum. Numerical calculations of the first two moments of the electron distribution curve in lead were carried out for a primary photon spectrum of the form 1/E. The cascade curves in lead were computed from the known moments $\bar{t}$ and $\bar{t}^2$. The results of the calculations are compared with experiment. (auth)

4628

SELECTION RULES FOR ANTIPROTON ANNIHILATION INTO π-MESONS. L. M. Afrikian (Academy of Sciences, USSR and Academy of Sciences, Armenian SSR). Soviet Phys. JETP 4, 135-7(1957) Feb.

A possible generalization of the selection rules to the production of an arbitrary number of π mesons is considered. The dependence of the effective cross sections for antiproton annihilation on its velocity is also discussed. (B.J.H.)

NUCLEAR PROPERTIES

4629 AERE-N/M-28

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SENSITIVITY OF SPHERICAL SHELL METHOD FOR X SECTION DETERMINATION. M. J. Poole. Oct. 7, 1948. Decl. Dec. 20, 1956. 5p.

A fast neutron absorption cross section may be determined by observation of the counting rate due to a spherically symmetric neutron source with and without a spherical shell of absorbing material around the source. The minimum cross section that can be found in this way is discussed. The various factors which limit the sensitivity of the method are outlined. These include statistical accuracy of counting, errors from lack of centering the source in the absorber, intrinsic lack of symmetry in source and sphere, counting system stability, and counter sensitivity variation. It is concluded that the ultimate sensitivity of the method may be put at 0.03 barns. (B.J.H.)

4630 AERE-R/M-93

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ACTIVATION RESONANCE INTEGRAL OF BISMUTH. P. N. Cooper. Nov. 1956. 12p.

The resonance integral for β activation of Bi has been determined by measuring the Cd ratio in a pile spectrum. In the same spectrum the Cd ratio of Mn, having a known resonance integral, was determined in order to calibrate the epithermal component of the spectrum. The value obtained for the resonance integral, not including the $(1/v)$ contribution, was $(3.79 \pm 0.38)\sigma_0$ or 76 ± 8 mb referred to a 2200 m/s activation cross section, σ_0, of 20 mb. (auth)

4631 CRRP-680

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

EFFECTIVE CROSS SECTION VALUES FOR WELL-MODERATED THERMAL REACTOR SPECTRA. C. H. Westcott. Jan. 25, 1957. 26p. (TNCC(Can)-7; AECL-407).

Effective cross section values for the spectra of typical thermal reactors are compiled. (B.J.H.)

4632 ISC-758

Ames Lab., Ames, Iowa.

SEMI-ANNUAL SUMMARY RESEARCH REPORT IN PHYSICS FOR JANUARY THROUGH JUNE 1956. Oct. 24, 1956. 37p. Contract W-7405-eng-82. $0.25(OTS).

Studies on the binding energy of light hyperfragments are summarized. The shape factor for the β decay of C^{14} was calculated. The excitation of isomers in the region of the deformed nuclei by x rays from a 75-Mev synchrotron was completed, and resulting data are tabulated. The thermal diffusivity and the electrical resistivity of Th were measured in the temperature ranges 200 to 1000°C and 50 to 1000°C, respectively. The results are shown graphically. From these data, the thermal conductivity of Th was also calculated. The electric resistivity of thin K films at 100°K was measured as a function of thickness from 148 to 1600 A. The electrical properties of evaporated C films were also studied. Data concerning the resistivity of Mg_2Pb single crystals and copper selenide are shown graphically. Heats of sublimation are given for Sm, Tm, and Yb. (For preceding period see ISC-707.) (B.J.H.)

4633 KAPL-1635

Knolls Atomic Power Lab., Schenectady, N. Y.

GROUP AVERAGED ABSORPTION CROSS SECTIONS IN THE RESONANCE REGION FOR SOME HAFNIUM ISOTOPES. T. F. Ruane, M. L. Storm, P. J. Tetrault, and M. C. Conerty. Nov. 28, 1956. 31p. Contract W-31-109-Eng-52. $0.25(OTS).

Group averaged microscopic absorption cross sections are calculated for Hf-177, -178, and -179. These cross sections are then applied to the evaluation of central reactivity coefficients for zero thickness samples in an intermediate spectrum reactor, and comparison is made with experimental reactivity coefficients measured in a critical assembly. Experimental and calculated reactivity coefficients for the three isotopes agree to within 20%. Consideration is also given to other hafnium isotopes (174,176,180) for which less information is available. (auth)

4634

ON THE DETERMINATION OF THE CHARACTERISTIC PARAMETERS OF A NUCLEAR RESONANCE LEVEL. Shigueo Watanabe. Anais acad. brasil. cienc. 28, 243-51 (1956). (In Portuguese)

4635

POSSIBILITY OF A LEVEL AT 3.41 Mev IN C^{13}. J. Catala, E. Villar and A. Bonet. Anal. real. soc. espan. fis. y quim. (Madrid) Ser. A 52, 251-8(1956) Nov.–Dec. (In Spanish)

The photographic method has been used in the study of the products of nuclear processes occurring when acetylene gas is bombarded by 19.17-Mev deuterons. A search was made for a monoenergetic group of protons corresponding to a level in C^{13} at 3.41 Mev, which seems to appear in 11 of the 13 angles studied. (auth)

4636

MAGNETIC RESONANCE. Clyde A. Hutchison, Jr. (Univ. of Chicago, Ill.). Ann. Rev. Phys. Chem. 7, 359-82(1956).

A summarization of the literature on nuclear and electronic magnetic resonance and the chief applications to chemistry is given. (T.R.H.)

4637

DETERMINATION OF THE ELECTRIC QUADRUPOLE OF THE Zn^{67} NUCLEUS BY MEASUREMENT OF THE HIGH FREQUENCY TRANSITION IN THE 4^3P_1 PHASE OF Zn^{67} ATOM. Klaus Bockmann, Hubert Kruger and Ekkehard Recknagel. Naturwissenschaften 44, 7-8(1957) Jan. (In German)

4638

TRILINEAR CHART OF NUCLIDES. William H. Sullivan. Oak Ridge, Oak Ridge National Lab., 1956. 6p and chart. (Available from U. S. Government Printing Office for $2.00)

4639

TOTAL NEUTRON SCATTERING IN VITREOUS SILICA. R. J. Breen, R. M. Delaney, P. J. Persiani, and A. H. Weber (St. Louis Univ., Mo. and Argonne National Lab., Lemont, Ill.). Phys. Rev. 105, 517-21(1957) Jan. 15.

The structure of Corning superpure vitreous silica glass has been investigated with neutrons. A new method of analysis using variable neutron wavelengths and the measurement of total scattering cross sections from transmission experiments is developed and the results are compared with those from differential x-ray scattering. The total neutron scattering method permits a simple and direct structure analysis with resolution apparently superior to x rays. The preliminary results compare well in a first approximation analysis with the basic structure model of Warren and others and in addition the neutron-determined atomic radial distribution curve exhibits some finer details than the x-ray results. Thermal inelastic scattering of neutrons was corrected for in an approximate way. (auth)

4640

HYPERFINE STRUCTURE OF Cu^{63} AND Cu^{65}. Y. Ting and H. Lew (National Research Council, Ottawa, Can.). Phys. Rev. 105, 581-8(1957) Jan. 15.

The hyperfine splittings of the electronic ground states of the stable copper isotopes Cu^{63} and Cu^{65} have been measured by the atomic beam magnetic resonance method. The

magnitudes of these splittings are $\Delta\nu(Cu^{63})$ = 11 733.83 ± 0.01 Mc/sec, $\Delta\nu(Cu^{65})$ = 12 568.81 ± 0.01 Mc/sec, and their ratio is $\Delta\nu_{63}/\Delta\nu_{65}$ = 0.933567 ± 0.000002. If this ratio is compared with the ratio of the magnetic moments as measured by nuclear magnetic resonance, viz. μ_{63}/μ_{65} = 0.933424 ± 0.000019, one finds a "hyperfine structure anomaly" of $\Delta = [\Delta\nu_{63}\cdot\mu_{65}/\Delta\nu_{65}\cdot\mu_{63}] - 1 = (0.015 \pm 0.002)\%$. Measurements of the "low-frequency" lines of the two isotopes yield the following values for the Landé g factors of the ground states: $g_J(Cu^{63}) = g_J(Cu^{65}) = (1.0000 \pm 0.0005)g_J(Cs^{133})$. (auth)

4641

MAGNETIC MOMENTS AND HYPERFINE-STRUCTURE ANOMALIES OF Cs^{133}, Cs^{134}, Cs^{135}, AND Cs^{137}. H. H. Stroke, V. Jaccarino, D. S. Edmonds, Jr., and R. Weiss (Massachusetts Inst. of Tech., Cambridge, Mass.). Phys. Rev. 105, 590-603(1957) Jan. 15.

The atomic-beam magnetic-resonance method was used to measure the nuclear gyromagnetic ratios and hyperfine-structure separations of the radioactive isotopes Cs^{134}, Cs^{135}, and Cs^{137}. A surface ionization detector was used. The hyperfine-structure separations were obtained by direct $\Delta F = \pm 1$ transitions near zero field. The values of $\Delta\nu$ found for the three isotopes are: $\Delta\nu(Cs^{134})$ = 10 473.626 ± 0.015 Mc/sec, $\Delta\nu(Cs^{135})$ = 9 724.023 ± 0.015 Mc/sec, and $\Delta\nu(Cs^{137})$ = 10 115.527 ± 0.015 Mc/sec. Pairs of transition belonging to the two different F states, but involving the same m_F values, constitute frequency doublets separated by $2g_J\mu_0H$. From measurements of the difference frequencies of these doublets for pairs of isotopes in fields in the vicinity of 9000 gauss, the following g-value ratios were obtained: $g_I(Cs^{135})/g_I(Cs^{133})$ = 1.05820 ± 0.00008, $g_I(Cs^{137})/g_I(Cs^{135})$ = 1.04005 ± 0.00008, $g_I(Cs^{134})/g_I(Cs^{133})$ = 1.01447 ± 0.00029. The hfs anomalies arising from the variation of the electron wave function over the finite distribution of nuclear magnetization were calculated from these measurements. The values found for these anomalies, defined by $\epsilon_2 - \epsilon_1 = [g_I\Delta\nu_2(2I_1 + 1)]/[g_2\Delta\nu_1 \times (2I_2 + 1)] - 1$, are: $\epsilon(Cs^{133}) - \epsilon(Cs^{135}) = +0.037 \pm 0.009\%$, $\epsilon(Cs^{135}) - \epsilon(Cs^{137}) = -0.020 \pm 0.009\%$, and $\epsilon(Cs^{133}) - \epsilon(Cs^{134}) = +0.169 \pm 0.030\%$. The theory of Bohr and Weisskopf on the hfs anomalies was applied to these nuclei; the calculations are based primarily on a single-particle model with varying distributions of spin and orbital contribution to the nuclear moment. An apparent magic number effect in the anomalies was observed. (auth)

4642

NEUTRON TRANSMISSION MEASUREMENTS AND RESONANCE PARAMETERS IN Cd. F. B. Simpson and R. G. Fluharty (Phillips Petroleum Co., Idaho Falls). Phys. Rev. 105, 616-19(1957) Jan. 15.

Neutron transmission measurements for cadmium have been determined from 14.5 ev to 11 kev. These data were taken with 0.04 to 0.07 μsec/meter resolution using the Materials Testing Reactor fast chopper. Isotopic assignments have been made to those resonances which are due to Cd^{111} and Cd^{113} by using a sample enriched in Cd^{111} and another sample depleted in Cd^{113}. Breit-Wigner parameters have been obtained up to 215 ev and give values for $\overline{\Gamma_n^0}/D$ of $(0.33 \pm 0.09) \times 10^{-4}$ for Cd^{111} and $(0.43 \pm 0.13) \times 10^{-4}$ for Cd^{113}. (auth)

4643

ANGULAR MOMENTUM COUPLING IN THE NUCLEAR p SHELL. J. B. French (Univ. of Rochester, N. Y. and Sarah Mellon Scaife Radiation Lab., Univ. of Pittsburgh) and A. Fujii (Univ. of Rochester, N. Y.). Phys. Rev. 105, 652-7(1957) Jan. 15.

Certain experimental results involving the nuclei A = 6 to 10 are compared with the predictions of the simple spin-orbit coupling model for p-shell nuclei in order to investigate the validity of this model and in particular to consider the significance of nucleon reduced widths as determined by deuteron reactions. (auth)

4644

INELASTIC PROTON SCATTERING FROM GOLD AT 6 Mev. B. Elbek and C. K. Bockelman (Massachusetts Inst. of Tech, Cambridge, Mass.). Phys. Rev. 105, 657-61(1957) Jan. 15.

A thin gold target has been bombarded with 6.0-Mev protons. Inelastically scattered protons, corresponding to Coulomb excitation of the 545-kev, 279-kev, and 268-kev levels in Au^{197}, have been observed in a magnetic spectrograph. The angular distribution of the inelastic groups seems to follow the semiclassical theory. (auth)

4645

FIRST EXCITED STATE OF B^{11}: POSSIBILITY OF SPIN-FLIP STRIPPING. D. H. Wilkinson (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 105, 666-71(1957) Jan. 15.

The first excited state of B^{11} at 2.14 Mev emits γ rays which have an isotropic distribution when excited over a wide range of energy in the reaction $B^{11}(p,p')B^{11*}$ and an isotropic correlation in the reaction $B^{10}(d,p)B^{11*}$. The natural assumption is therefore that the state is of spin ½ as is suggested by the shell model. This assignment is supported by certain γ ray studies in the reaction $Li^7(\alpha,\gamma)B^{11}$. However, in both the reaction $B^{10}(d,p)B^{11}$ and the mirror reaction $B^{10}(d,n)C^{11}$ leading to this level or its mirror level in C^{11}, and l = 1 stripping pattern is found, suggesting $\frac{3}{2} \leq J \leq \frac{9}{2}$. The observed isotropies could be given by emission from a state of $\frac{3}{2}$- to the $\frac{3}{2}$- ground state if the gamma ray were purely E2. In the present investigation it is shown by a Doppler shift method using $B^{11}(p,p')B^{11}$ that the lifetime of the first excited state is less than 4×10^{-14} sec. It is shown that this limit is inconsistent with E2 sum rules and therefore that the transition is chiefly M1 and that the spin of the level must be ½-. This is consistent with the stripping result only if it is possible for the departing nucleon in such a reaction to flip its intrinsic spin and so transmit a further unit of angular momentum to the nucleus. (auth)

4646

QUADRUPOLE MOMENTS OF Os^{189}, Ta^{181}, Lu^{175}, AND La^{139}. Kiyoshi Murakawa and Tohru Kamei (Inst. of Science Tech., Tokyo). Phys. Rev. 105, 671-2(1957) Jan. 15.

The quadrupole moment of Os^{189} was determined from the hyperfine structure of the level $5d^66s^2\ ^5D_4$ of Os I and was found to be $Q(Os^{189}) = (+0.8 \pm 0.2) \times 10^{-24}$ cm² without shielding correction. The quadrupole moments (without shielding correction) of Ta^{181}, Lu^{175}, and La^{139} that were determined previously from the configurations $5d^36s^2$, $5d6s^2$, and $5d^26s$ respectively are, in units of 10^{-24} cm², +3.9 ± 0.4, +5.1 ± 0.3, and +0.5 ± 0.2 respectively. If one assumes a shielding correction of −0.3 for the 5d electron, these values become $Q(Os^{189}) = +0.6 \pm 0.14$ $Q(Ta^{181}) = +2.7 \pm 0.3$, $Q(Lu^{175}) = +3.6 \pm 0.2$, and $Q(La^{139}) = +0.3 \pm 0.1$ in units of 10^{-24} cm², where the probable error does not include the uncertainty of the shielding correction. (auth)

4647

ELECTRON-NEUTRINO ANGULAR CORRELATION IN THE BETA DECAY OF Ne^{19}. W. Parker Alford and Donald R. Hamilton (Princeton Univ., N. J.). Phys. Rev. 105, 673-8 (1957) Jan. 15.

The electron-neutrino angular correlation coefficient a has been determined in the β decay of Ne^{19} by observing the spectrum of positrons coincident with nuclear recoils emitted approximately antiparallel to the positrons. The source region in the volume containing the Ne^{19} activity was defined by a retarding grid system and by the requirement

that coincident recoils from the source exhibit the correct delay relative to the positrons. Negatively charged recoils were detected in a silver–magnesium alloy electron multiplier, which was also found to be fairly sensitive to uncharged recoils in the energy range below two hundred electron volts. Positron energies were determined with a crystal-photomultiplier spectrometer and multichannel analyzer. Comparison of the measurements with calculated spectra yields a value of $\alpha = -0.15 \pm 0.2$, confirming earlier conclusions that the β interactions has the form ST(P) rather than VT(P). Earlier measurements on the recoil spectrum using this apparatus had given $\alpha = -0.8 \pm 0.4$. The difference between this value and the present measurements was found to be due to uncertainties in circuit timing which have small effects on the electron spectrum but much larger effects on the spectrum of recoils. (auth)

4648

FLUORESCENCE YIELDS OF Ni, Cu, Zn, AND Pb. E. T. Patronis, Jr., C. H. Braden, and L. D. Wyly (Georgia Inst. of Tech, Atlanta). Phys. Rev. 105, 681-2(1957) Jan. 15.

A new method for measuring fluorescence yields is described. The method employs a radioactive source for fluorescence excitation and a proportional counter as a radiation detector. The K-shell fluorescence yields for Ni, Cu, and Zn were found to be 0.33 ± 0.02, 0.39 ± 0.02, 0.44 ± 0.02, respectively. The mean L-shell fluorescence yield of Pb was found to be 0.39 ± 0.02. (auth)

4649

LOW-LYING STATES OF N^{16}. D. H. Wilkinson (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 105, 686-91(1957) Jan. 15.

The γ rays of low energy resulting from the reaction $N^{15}(d,p)N^{16}$ have been studied. Gamma rays of energy 387 ± 5 kev, 268 ± 5 kev, and 118 ± 3 kev are observed by using NaI scintillation techniques, and the presence of another γ ray of 285 ± 8 kev is inferred. These results indicate states of N^{16} at 118, 285, and 387 kev consistent with earlier studies of heavy particles. The gamma ray of 268 kev results from a cascade from the 387-kev state through the first excited state which is shown to have a lifetime of a few microseconds. By combining these results with the earlier work on heavy particles, it is possible to fix the first excited state of N^{16} as 0– and the third as 1–. The second excited state is with very good probability 2– or 3– with a slight preference for 3–. The ground state is already known to be 2–. These results are in good accord with the theoretical (shell model) predictions of J. P. Elliott. (auth)

4650

PARAMAGNETIC RESONANCE SPECTRUM OF CURIUM. P. Fields, A. Friedman, and B. Smaller (Argonne National Lab., Lemont, Ill.) and W. Low (Univ. of Chicago, Ill.). Phys. Rev. 105, 757(1957) Jan. 15.

The paramagnetic resonance spectrum of curium in anhydrous lanthanum trichloride was observed at 3-cm wavelength and room temperature. (B.J.H.)

4651

THE AVERAGE NEUTRON TOTAL CROSS SECTIONS OF HEAVY ELEMENTS AT LOW ENERGY. D. B. Gayther and K. P. Nicholson (Atomic Energy Research Establishment, Harwell, Berks). Proc. Phys. Soc. (London) A70, 51-61 (1957) Jan.

A method is developed for determining the total cross section averaged over many resonances of an element from a direct measurement of the average transmission of a thick sample. This is used to obtain the average total cross sections of fourteen elements at energies from 1 to 30 kev from transmission measurements made with the Harwell Fast Chopper. Values of the potential scattering cross section and the ratio of average neutron width to level spacing are also obtained. The variations of these quantities with atomic weight are compared with the predictions of the strong and weak coupling models of the nucleus developed by Weisskopf et al. The fluctuations which are observed near atomic weight 150 are in qualitative agreement with the weak-coupling theory provided the nuclear radius is 1.45 $A^{\frac{1}{3}} \times 10^{-13}$ cm. (auth)

4652

THE DYNAMICAL MAGNETIC MOMENT OF THE DEUTERON. A. M. Korolev (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 4, 73-9(1957) Feb.

The dynamical magnetic moment of the deuteron is considered on the basis of the pseudoscalar meson theory with the pseudoscalar type of coupling, in the fifth order of perturbation theory. Exchange currents in the deuteron make an essential contribution to the dynamical magnetic moment. (auth)

4653

K-SHELL GAMMA RAY INTERNAL CONVERSION COEFFICIENTS. L. A. Sliv and I. M. Bank (Academy of Sciences, USSR). Soviet Phys. JETP 4, 133-5(1957) Feb.

Tables of coefficients of internal conversion were established which take into account the finite size of the nucleus and the screening effect. Low-energy values were included. (B.J.H.)

NUCLEAR REACTORS

4654 AERE-E/R-510

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE TRANSIENT POWER CHARACTERISTICS OF B.E.P.O. UNDER AN AUTOMATIC POWER REGULATOR. J. H. Bowen. Apr. 1950. Decl. Dec. 20, 1956. 21p.

A linear differential equation is experimentally obtained which approximately describes the pile and its associated control apparatus. A possible application is suggested and examples given. (auth)

4655 AERE-Inf/Bib-105

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SELECTED ABSTRACTS ON THE USE OF ORGANIC MATERIALS AS MODERATOR-COOLANTS OF REACTORS. G. Naish and R. W. Bowring. Aug. 1956. 11p.

4656 AERE-R/M-2

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

AN APPROXIMATE METHOD OF CALCULATING REACTOR TEMPERATURE COEFFICIENTS. J. Codd. Feb. 19, 1951. Decl. Dec. 20, 1956. 11p.

Formulas are obtained for the changes in reproduction constant and migration length of a lattice when the temperatures of the moderator and uranium rise above room temperature. Only nuclear effects are considered, changes in the lattice geometry and density of the materials due to thermal expansion being neglected. It is assumed that the absorption cross-sections of uranium, sheath and moderator obey the 1/v law when the mean thermal neutron energy changes, and that the scattering cross-sections remain constant. Two nuclear parameters required in the investigation are so chosen as to make the theoretical values of the temperature coefficients of BEPO agree with experimental values. The theory is applied to a lattice of interest in the MkI enriched reactor program. The uranium temperature coefficient is found to be about the same as for BEPO, namely -1.6×10^{-5}, whereas the moderator coefficient is greater, namely -6.4×10^{-5} as compared with -3.3×10^{-5} for BEPO. (auth)

4657 AERE-R/M-97
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE NEUTRON SPECTRUM, THERMAL UTILISATION AND CONVERSION FACTOR IN L.M.F.R. W. G. Davey. Oct. 1956. 13p. (LMFS/P-5).

Calculations are made of an ideal conversion factor for a liquid metal fueled reactor. Complete results are tabulated. (B.J.H.)

4658 AERE-R/R-842(Del.)
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
SHIELDING STUDIES. [PART] I. FAST NEUTRON FLUXES FROM GRAPHITE MODERATED URANIUM REACTORS. R. M. Absalom, D. R. Caunter, C. C. Horton, M. U. Lea, and L. R. Shepherd. Dec. 1951. Decl. with deletions Nov. 26, 1956. 33p.

Experiments have been performed on the attenuation of fast neutrons from a U fission neutron source through thicknesses of graphite up to 1 meter, and through two different thicknesses of steel. The neutrons were detected by two different kinds of counter; a thick polythene radiator whose response is energy-dependent above a threshold of ~800 kev; and, a flat response counter (long counter) whose response is essentially independent of energy between at least 30 kev and 5 Mev. The space distribution of both groups of neutrons may be fitted to simple formulae. The distribution of 2-Mev neutrons in the core and reflector of BEPO has also been calculated; measurements have been made using the sulfur activation methods, which show reasonable agreement with the calculated values. The neutron energy spectrum above 1 Mev in BEPO has been measured using the recoil proton method in Ilford 100μ C2 emulsions, these measurements were combined with the sulfur activation method mentioned above to obtain the fast neutron flux. The neutron spectrum above 1 Mev from thermal fission of U^{235} has also been measured, this measurement combined with the known energy dependence of the polythene detector indicates the effective energy of the neutrons measured by this detector to be 2 Mev. (auth)

4659 AERE-RE/M-2
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
MEASUREMENT OF FLOW THROUGH REACTOR FUEL ELEMENTS. A. Smith. May 18, 1955. Decl. Nov. 26, 1956. 4p.

The incorporation of a coolant flow measuring device into each fuel element of a DIDO-type reactor is discussed. (auth)

4660 AERE-RP/M-48
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
ZEPHYR PERTURBATION STUDIES. Interim Report. H. Rose and R. D. Smith. Sept. 17, 1954. Decl. Nov. 26, 1956. 5p.

The reactivity changes produced by the introduction of small samples of about 50 elements into the core of the Zephyr fast reactor have been measured. Effective capture and transport cross sections are tabulated. (auth)

4661 AERE-RP/M-49
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
FLUX MEASUREMENTS IN ZEPHYR. Interim Report. J. E. R. Holmes. [1954?]. Decl. Nov. 26, 1956. 21p.

The variation of the fission rates of Pu^{239}, U^{233}, U^{235}, U^{238}, and natural U has been investigated throughout the reactor. The fission cross-sections of these materials have been deduced assuming the cross section for fission of Pu^{239} has a constant value of 1.98 barns in the reactor. These measurements indicate that an equilibrium spectrum exists in the core and, as the neutrons diffuse outwards, this distribution becomes degraded by inelastic scattering, until a second equilibrium spectrum is reached in the outer parts of the envelope. The values obtained for cross sections in the core correspond in most cases, to the cross sections for monokinetic neutrons of about 600 kev. This may be compared with a value of about 1 Mev to be expected as the 'equivalent energy' for an undegraded fission spectrum. The corresponding 'equivalent energy' for the equilibrium spectrum in the envelope is about 100 kev. The diffusion length in natural U, based on an assumption of spherical symmetry and applying one group theory, has been found to be 11.9 ± 0.4 cms, in agreement with the previously reported value. Integrations have been made of the fission rates over the whole of the reactor. These integrations, when combined with estimates of capture in U^{238} and neutron leakage from the outside of the envelope, indicate that the conversion factor for Zephyr is approximately 2. (auth)

4662 AERE-T/R-503
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A METHOD OF CALCULATING THE RELATIVE HEAT OUTPUT OF THE TAMPER. H. Melvin-Melvin. Mar. 1950. Decl. Nov. 26, 1956. 4p.

A method of calculating heat generation in the reflector is presented. This method differs from previously used methods in that both elastic and inelastic scattering and neutron energy degradation from collisions are considered. (D.E.B.)

4663 AMF-GR-4-55
American Machine and Foundry Co. General Engineering Lab., Greenwich, Conn.
NUCLEAR FUEL COST FOR THE AMF CLOSED CYCLE BOILING WATER REACTOR. Franz S. Holzer. June 17, 1955. Decl. Feb. 13, 1957. 19p. (ER-6842; G-3608). $3.30(ph OTS); $2.40(mf OTS).

An estimate was made of the cost of the nuclear fuel and of the value of the total fuel inventory for the 22-Mw closed cycle boiling water reactor. Based on reasonable design objectives and economy in fabrication and reprocessing of fuel elements, the nuclear fuel cost would be 0.707 mils per KWH of heat or 1.86 mils per KWH of electricity. The total fuel inventory would be about $1,400,000. An alternate core design was also considered in order to obtain an upper limit of the costs. These upper limits are 1.59 mils per KWH of heat, 4.2 mils per KWH of electricity, and a total inventory of $1,750,000. The target design is based on a natural U core with fully enriched U at the center. (B.J.H.)

4664 ANL-5601
Argonne National Lab., Lemont, Ill.
REACTOR ENGINEERING DIVISION QUARTERLY REPORT [FOR] APRIL, MAY, JUNE 1956. SECTION II. Dec. 1956. 89p. Contract W-31-109-eng-38. $0.50(OTS).

Advanced water reactor program. Progress on the design of the Experimental Boiling Water Reactor is summarized. A mockup of the pressure vessel and part of the shield of the EBWR were installed in the Bathtub Shielding Facility in the CP-5 in order to determine the relative effects of mild steel and boron-stainless steel thermal shields on thermal neutron flux at the pressure vessel wall as a function of the thickness of the water gap between the thermal shield and the vessel wall. Data on the compressive strength of concrete shield specimens are tabulated. The construction status of the EBWR is also reviewed. The

theory of the stability of bubbling reactors is outlined. Flow models for boiling water passing upward through heated rectangular channels are discussed. The effect of oxygen addition on water decomposition is also studied. Data are included on the effect of fused salt treatment on the corrosion of Zircaloy 2 in static degassed water at 680°F. Data are also given on the corrosion of Zircaloy-2 ingots and Al alloys, the boiling corrosion of Al–Ni clad stainless steel tube, and on the corrosion-irradiation of Al–Ni alloys. Irradiation tests on urania–thoria fuel pins are summarized. The temperature gradient through the fuel pin was calculated. The stress distribution in the pin is also shown. Data are tabulated on the dynamic and static corrosion of boron-stainless steel. Some data are also included on the static corrosion of miscellaneous structural materials. Fast power breeder reactor program. The nuclear properties of an EBR-II design study were evaluated on the basis of one-dimensional diffusion theory calculations. Irradiation tests of EBR-II type fuel elements are summarized. Heat transfer properties and thermal stresses for the insulation in the EBR-II primary Na system are listed. Temperature profiles through the inner pipes of the system are shown. The operation of the EBR-II control rod mechanism is also discussed. (For preceding period see ANL-5572.) (B.J.H.)

4665 ANL-5652
Argonne National Lab., Lemont, Ill.
UNDERGROUND CONSTRUCTION OF POWER REACTORS. D. R. Inglis and G. R. Ringo. Jan. 1957. 6p. Contract W-31-109-eng-38. $0.15(OTS).

4666 CF-55-5-156(Rev. III)
Oak Ridge National Lab., Tenn.
HRT PROCESS FLOWSHEETS. Revision III. F. C. Zapp. Jan. 30, 1957. 27p. Contract [W-7405-eng-26]. $6.30 (ph OTS); $3.00(mf OTS).

4667 CF-55-8-111
Oak Ridge National Lab., Tenn.
SPECIFICATIONS FOR HRT REACTOR AND SERVICE SYSTEMS. W. R. Gall. June 7, 1956. 284p. Contract W-7405-eng-26. $1.50(OTS).

4668 CF-56-1-122
Oak Ridge National Lab., Tenn.
HRT SAMPLE CARRIER SHIELDING CALCULATIONS. D. M. Johnson. Jan. 24, 1956. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Calculations are presented for the determination of radiation leaking from a lead carrier used for transporting samples of HRT fuel solutions. (W.L.H.)

4669 CF-56-1-159
Oak Ridge National Lab., Tenn.
EFFECTS OF REDUCTION IN THICKNESS OF SAMPLER SHIELD PLUG. P. N. Haubenreich. Jan. 31, 1956. 3p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The original design of the HRT sampler included a shield plug 25 in. thick containing Pb shot in H_2O. Because the sampler valves are longer than expected it is necessary to reduce the shield thickness. Calculations indicate that the shield could be reduced as much as 4 in. without serious consequences. (W.L.H.)

4670 CF-56-2-59
Oak Ridge National Lab., Tenn.
REVISED ESTIMATES OF NEUTRON LEAKAGE THROUGH SAMPLER SHIELD PLUG. P. N. Haubenreich. Feb. 14, 1956. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

When it was found necessary to reduce the design thickness of the sampler shield plug to accommodate longer sampler valves, calculations were made to estimate the radiation leaking through the plug in the HRT. (W.L.H.)

4671 CF-56-4-4
Oak Ridge National Lab., Tenn
CALCULATION OF EFFECTS OF COPPER CATALYST IN THE HRT. R. E. Aven and M. C. Lawrence. Apr. 10, 1956. 51p. Contract [W-7405-eng-26]. $9.30(ph OTS); $3.60(mf OTS).

A study has been made of internal recombination of radiolytic gases in the HRT solutions using dissolved Cu catalyst. Calculations have been made to determine the fraction of radiolytic gas production which is recombined internally as a function of copper concentration. This has been done for several power levels, operating temperatures, and pressures. The fraction of radiolytic gas recombined internally is shown (for several power levels) as a function of Cu concentration. The effect of power level on the Cu concentration required is presented for several fractions of gas recombined internally. The effects of overpressure and operating temperature are shown. (auth)

4672 CF-56-7-97
Oak Ridge National Lab., Tenn.
THE CALCULATION OF GAMMA HEATING IN REACTORS OF RECTANGULOID GEOMETRY. H. C. Claiborne and T. B. Fowler. July 20, 1956. 24p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A method of calculating heat generation due to γ ray absorption in structural members of reactors of rectanguloid geometry was devised. The calculated results checked experimental measurements in the Bulk Shielding Reactors to within ± 23% for three different target metals. It is concluded that the model used represents the mechanisms involved to a fair approximation and should be adequate for design purposes. (auth)

4673 CF-56-8-156
Oak Ridge National Lab., Tenn.
HAZARD TO HRT CONTAINMENT CELL FROM ZIRCONIUM–WATER REACTION OR D_2 EXPLOSION. M. W. Rosenthal. Aug. 24, 1956. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The energy release, explosion hazard, and cell pressures developed with and without an explosion have been examined for a number of situations involving rupture of the high-pressure system of HRT. Analysis of the effects of a metal-water reaction reveals that more than 10% of the Zr must react before the static cell pressure (without an explosion) is increased appreciably by the additional energy release. If uniformly dispersed, the gas in the cell would be explosive only if reaction of more than 10% of the Zr occurred and if this was accompanied by condensation of all steam present. (auth)

4674 CF-56-9-27
Oak Ridge National Lab., Tenn.
NATURAL CIRCULATION RECOMBINER REPORT. I. K. Namba. Sept. 10, 1956. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The recombiner consists of a cylindrical shell which houses a flue or chimney containing a catalyst bed, cooling coil and heaters. A metered quantity of H_2 and O_2 is introduced into the annular space and recombination takes place as the gas mixture is swept through the catalyst by convection. The unit operated smoothly with a H_2 flow of 1.06 scfm, using steam diluent at 100 psia. Using air diluent at 15 psia, the unit operated satisfactorily with H_2 flow up to 0.20 scfm. (auth)

4675 CF-56-11-36
Oak Ridge National Lab., Tenn.
COMPARISON OF CALCULATED VS MEASURED GAMMA-RAY HEATING IN THE BULK SHIELDING FACILITY. H. W. Bertini, C. M. Copenhaver, H. C. Claiborne, and

T. Fowler. Nov. 12, 1956. 18p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A comparison has been made between corresponding calculated and experimental γ-ray heating results for the Bulk Shielding Reactor. The calculated γ-ray heat generation rates were obtained assuming straight exponential absorption of γ rays, with narrow beam absorption coefficients, and energy absorption buildup factors based on isotropic sources in a homogeneous medium. The calculated results agreed with the experimental measurements to within −15% to +5% for three different target metals. For the heavy Z targets, i.e., iron and lead, the principal difference between the experimental and calculated curves was accounted for by the rapid absorption of the low energy γ spectrum built up in the light Z material. It is concluded that the methods and data outlined should yield results generally acceptable for reactor design purposes. (auth)

4676 CF-57-1-103
Oak Ridge National Lab., Tenn.
DELAY TIME PRIOR TO DUMPING THE HRT. E. H. Gift and H. A. McLain. Jan. 10, 1957. 24p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Some refined calculations have been made, relative to a proposed delay prior to a dump, to determine the expected D_2 concentration in the vent stream from the pressurizer gas bleeds during a dump of the HRT. These calculations indicate that for vent valves having a Cv of 0.07 (venting time from 2000 psia to D_2O saturation pressure of approximately 12 minutes), a delay period is not required since the D_2 concentration is well below the lower explosive limit. For vent valves having a Cv of 0.3 (venting time approximately 2.4 minutes), the calculations indicate that a delay before venting of approximately two minutes will be required. This is due entirely to the possibility of mass ebullition of the D_2. Since the pressure drops so quickly, the reactor solution becomes saturated with D_2 before appreciable recombination can occur. (auth)

4677 CF-57-1-120
Oak Ridge National Lab., Tenn.
THE CHEMICAL PROCESSING OF TWO-REGION AQUEOUS HOMOGENEOUS REACTORS. D. E. Ferguson. Jan. 29, 1957. 21p. Contract [W-7405-eng-26]. $4.80 (ph OTS); $2.70(mf OTS).

A promising scheme for the chemical processing of a Th breeder reactor of the two-region aqueous homogeneous type consists of the following operations: concentration of insoluble fission and corrosion products from the core system into a small volume of fuel solution, combining this slurry with irradiated ThO_2 slurry taken from the blanket, recovery of D_2O by evaporation, dissolution of the Th and U in HNO_3, and after a suitable cooling period recovery of the U and Th by solvent extraction for return to the reactor. The use of a hydroclone and underflow container arrangement for concentrating insoluble fission and corrosion products under simulated reactor conditions has been successfully demonstrated on dynamic loops. An alternate method of processing the slurry removed from the core system by the hydroclone consists of removing the room temperature insolubles by centrifugation, recovering the U from the supernatant by peroxide precipitation, thermal decomposition of the UO_4 in dilute deuterated H_2SO_4 to produce reactor fuel. This method has been successfully tested on a laboratory scale using a simulated hydroclone underflow slurry. The results of laboratory and loop studies of iodine chemistry indicated that iodine is sufficiently volatile under reactor conditions to be removed by gas stripping. The effect of radiation, temperature and other fission products on iodine valence have been studied. (auth)

4678 CF-57-1-143
Oak Ridge National Lab., Tenn.
STRESS-CORROSION CRACKING PROBLEMS IN THE HOMOGENEOUS REACTOR TEST. E. G. Bohlmann and G. M. Adamson. Jan. 31, 1957. 25p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Chloride-induced stress-corrosion cracking has been encountered in the Homogeneous Reactor Test during the preliminary testing. The reactor is constructed of austenitic stainless steels. It is unique in that it will operate at 250 to 300°C with an aqueous UO_2SO_4 solution fuel containing 200 to 500 ppm of dissolved oxygen. The cracking has occurred in a secondary system used for detecting leaks in the flanged joints of the primary systems and in the grooves of flanges in the primary systems. Tubing used in the leak-detection system was found to be contaminated with chloride introduced during manufacture. Examples of cracking of tubing and flanges are shown. In the laboratory it has been demonstrated that stress-corrosion cracking of austenitic stainless steels does not occur in oxygenated UO_2SO_4 solutions unless chlorides are present. Results of the laboratory studies and studies in engineering loop experiments are discussed. (auth)

4679 CF-57-1-150
Oak Ridge National Lab., Tenn.
ESTIMATED GAMMA RADIATION LEVELS AT ACCESS HOLES IN THE HRT SHIELDING. C. W. Collins. Jan. 24, 1957. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

An estimate has been made of the γ radiation levels at access holes in the HRT shielding when the plugs have been removed to service or maintain the reactor. In every case the radiation level at the holes was greater than the maximum permissible exposure rate of 0.3 roentgens per week. The radiation through the holes can be attenuated to some extent by flooding the reactor cell up to the flange to be disconnected. However, shielding would still be required and it is more practical to provide a small additional shield thickness to compensate for the moderate attenuation that could be gained from flooding. Where it is necessary to remove the roof shielding to service or maintain equipment after the reactor has been shut down, the top layer of shielding can be removed and the radiation dose rate through the bottom layer of shielding will be in the order of 0.4 milliroentgens per hour. Before the bottom layer of roof shielding is removed the cell should be flooded to the 830 foot elevation or other means taken to reduce the radiation. Radiation can be reduced to the permissible level by developing special procedures and designing shielding and handling equipment to be used when the plugs have been removed from the access holes. Shielding should be designed so that it can be set in place over the access hole by remote handling immediately following removal of the plug. The tooling should be designed to work through the shielding and must be operated remotely so that the operator is never in a direct line with any opening in the shielding. Shielded carrier designs should be based on the physical limitations of available handling equipment (crane capacity, etc.), and should provide for the addition of additional shielding to compensate for contingencies. Shielding thickness should be based on attenuating the radiation to the maximum permissible exposure rate of 0.3 roentgen per 40-hour week. The handling procedures require limiting the exposure to direct radiation from holes in shielding, etc., to the above limit or some slightly larger limit consistent with economic, design, and safety limitations. (auth)

4680 CF-57-1-159
Oak Ridge National Lab., Tenn.
HRT TEMPERATURE MEASUREMENT SYSTEMS—

ISSUE NO. 3. J. D. Grimes. Jan. 17, 1957. 39p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

A tabulation of data concerning the thermocouples installed in the HRT is presented. (T.R.H.)

4681 DR-22(Rev. 2)

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

CHALK RIVER PROSPECTS FOR ATOMIC POWER. W. B. Lewis. Jan. 7, 1957. 38p. (AECL-395).

The successful long irradiation of U in the NRX reactor and also the high temperature (500°F) of a successful coolant system in 1951 brought the expected cost of producing power from natural U reactors into competition with coal-fired power generating costs. An analysis is presented of the cost relations for "power-breeder" and natural U reactors. Although "power breeder" reactors form an essential element in generating large scale power, of the order of 10^9 to 10^{10} kw continuous output, forecast as attainable by known atomic energy technology from accessible fuel resources, it is pointed out that, at every stage, power of the order of 10^8 to 10^7 kw may be contributed at no greater cost by natural uranium reactors. This may be compared with the present Canadian total hydroelectric capacity of 10^7 kw. The cost of plutonium, assumed at $120/gm, may be expected to fall in a few years to $60/gm, and then, as a result of the exponential growth of a power-breeding program, to something little more than its basic value as a direct fuel assessed as $6/gm. This falling price will raise the net power costs from both "power-breeder" and natural U power reactors, but anticipated advances in technology may be expected to keep both in economical operation. Canada, having natural supplies of uranium, could profit from a relatively large exploitation of the natural uranium power reactor. With Pu valued at no more than $120/gm, there is early prospect that a natural uranium power reactor could be built to deliver electrical power at no cost, the revenue from the sale of the Pu produced being large enough to defray operating costs and annual charges. With the anticipated fall in the price of Pu, such a reactor should still compete favorably with coal-fired stations. A tentative basic introduction is given to the complexities of enriched reactor economics and basic design principles. Reference is made to speculations on alternative, possibly economical, methods of producing both power and fissionable material. In the present state of knowledge and technique these, although significant, are relatively remote possibilities. It is unlikely that such methods would make the operation of any established reactor uneconomical, since the fuel and operating costs of the reactors envisaged account for less than half the total power generating costs. (auth)

4682 HW-42055

Hanford Atomic Products Operation, Richland, Wash.

CURVES OF THE EXCESSIVE ABSORPTION TERM (E-1). Donna D. Matsumoto. Oct. 5, 1956. 12p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

Curves are presented of the excessive absorption term (E-1) in the equation for the thermal utilization for a reactor with long cylindrical fuel rods and an equivalent cylindrical lattice cell. (B.J.H.)

4683 HW-45567

[Hanford Atomic Products Operation, Richland, Wash.]

THE CREEP OF ZIRCALOY-2 PROCESS TUBES. A. B. Burgess. Sept. 17, 1956. 14p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The creep problems associated with Zircaloy-2 process tubes and the factors affecting the creep of these tubes are discussed in detail. Emphasis was placed on the determination of the tube wall thickness for an SPR tube, whose minimum thickness is limited by creep considerations. It was concluded that there is not enough information available to design Zircaloy-2 process tubes on a realistic basis. Various experiments are suggested to supplement the creep rate testing program being pursued. (auth)

4684 HW-45965

Hanford Atomic Products Operation, Richland, Wash.

ELASTIC SOLUTION FOR THE THERMAL STRESSES IN A FINITE SOLID CYLINDER FUEL ELEMENT. J. J. Cadwell and K. R. Merckx. Oct. 12, 1956. 27p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

The elastic solution is derived for the thermal stresses and displacements of a finite solid cylindrical element subjected to a radially dependent temperature distribution. The numerical calculations, based on this solution for 4- and 8-in. U rods of 1.4-in. diameter subjected to a 200°C temperature drop, show that: the maximum circumferential and axial tensile stresses of 29,200 psi occur at the outer surface in the central region of both rods, the stresses predicted by the plain strain or infinite cylinder solution are altered in the region of one radius distance from the end of the rods, all of the thermal stress magnitudes are decreased or remain essentially constant near the end of the cylinder, and non-uniform displacements at the end of the rod can cause tensile and bending stresses in welded sections between the can and end cap of a fuel element assembly. (auth)

4685 IDO-16314

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

MTR TECHNICAL BRANCH QUARTERLY REPORT—THIRD QUARTER. 1956. W. P. Conner, ed. Nov. 1, 1956. 78p. Contract AT(10-1)-205. $0.45(OTS).

An MTR fuel plate was seriously deformed during a hydraulic flowtest of a fuel assembly. The deformation was traced to faulty fabrication. The low level α contamination in the MTR process water appears to arise from a U impurity in the Be reflector. The operation of auxiliary facilities is briefly summarized. Preliminary design data are included for a proposed Shielding Experiments Reactor. An evaluation was made of 20% enriched fuel for high flux reactors. Critical size estimates were made for a proposed SPERT III reactor. Calculations were also made of the maximum neutron flux which can be realized in a testing reactor limited only by the maximum heat fluxes now obtainable only in the laboratory. Eta measurements on U^{233} are reported, as are its resonance parameters in the energy region below 4.0 ev. Preliminary data are included on the U^{233} fission cross section. Control circuits and detector pulse circuits for the 1024 channel analyzer are shown. The decay scheme of 11 hr Y^{93} is given. The pile neutron absorption cross section of Tm^{170} was found to be 150 barns. (For preceding period see IDO-16297.) (B.J.H.)

4686 IGR-TN/W-453

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

THE WINDSCALE AIR-FLOW RIG FOR HEAT TRANSFER MEASUREMENTS. A. Atherton and G. Horn. Feb. 1957. 15p.

An air-flow rig for measuring the heat transfer of fuel element can surfaces under simulated reactor conditions is described, and the expression of comparative results in the dimensionless forms of Stanton number, friction factor, and Reynolds number discussed. Details are given of the measuring techniques employed and estimates of error, also of the experimental checks carried out. The general results are satisfactory for the purpose required, but possible means of refinement and improvement are indicated. (auth)

4687 KAPL-1601
Knolls Atomic Power Lab., Schenectady, N. Y.
GAMMA BEAM ATTENUATION APPLIED TO SLURRY FUEL INVESTIGATIONS. J. R. Gould. July 2, 1956. Decl. Mar. 1, 1957. 17p. Contract W-31-109-Eng-52. $0.30(OTS).

The use of gamma ray attenuation to measure the amount and particle size of fuel suspended in liquid metal slurries is discussed. (auth)

4688 LA-1942
Los Alamos Scientific Lab., N. Mex.
A BRIEF DESCRIPTION OF A ONE MEGAWATT CONVECTION COOLED HOMOGENEOUS REACTOR — LAPRE II. L. D. P. King. Apr. 13, 1955. Decl. Aug. 17, 1955. 17p. Contract W-7405-eng-36. $0.20(OTS).

General descriptions are given of the LAPRE-II. It is intended to provide information on the corrosion and other properties of uranium phosphate solutions under operating conditions and to demonstrate the feasibility of a convection cooled power package reactor. Complete reactor specifications are listed. The reactor hazards are also briefly discussed. (B.J.H.)

4689 LEO/N-25
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
EFFECTS ON PERFORMANCE OF A LEO-TYPE REACTOR OF OMITTING THE CALANDRIA COOLING TUBES FROM THE CORE. W. M. Ogston. Oct. 11, 1955. Decl. Nov. 26, 1956. 10p.

It is shown that, in general, for a given diameter of fuel element, elimination of the calandria tubes enables the coolant flow to be increased by roughly twice if the coolant velocity is kept constant. Due to the reduced temperature rise of the coolant, a higher inlet temperature to the core may be used with a corresponding rise in the temperature at which steam may be generated in the heat exchanger. Thus doubling the flow in a particular case would lead to a rise in steam temperature of about 16°F with a consequent rise in steam pressure of about 73 psi. (auth)

4690 NPC-53/4(AERE)
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
NUCLEAR DESIGN OF FAST REACTORS. T. M. Fry and C. A. Rennie. Sept. 4, 1953. Decl. Dec. 20, 1956. 8p.

A general discussion is given on the design and components of fast reactors. Discussions are included on fissile material, source material, coolant, structural material, control, safety and neutron balance. (B.J.H.)

4691 NURG-M-14
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
EFFECT OF TURBULENCE IN PILE COOLING. O. Pulley. Feb. 11, 1952. Decl. Nov. 26, 1956. 8p.

From the general formulas for heat removal from a pile, equations are abstracted to show the effect of variation of the friction factor or turbulence on the more important quantities involved, i.e., output, fin area, and temperatures. Turbulence does not affect the maximum output which can be obtained, although it may help in attaining maximum conditions. It permits an appreciable reduction in fin surface area and/or an increase in outlet temperature. Suggestions are made for the detailed investigation of this important parameter. (auth)

4692 ORNL-2222
Oak Ridge National Lab., Tenn.
HOMOGENEOUS REACTOR PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING OCTOBER 31, 1956. Feb. 7, 1957. 185p. Contract W-7405-eng-26. $1.00(OTS).

Homogeneous Reactor Test. Operational experiences and difficulties encountered are recorded. The cooling water system was redesigned, and designing of the pressure balancing valve is completed. Design, fabrication, and testing of components, controls and instruments are continued. An analysis of excessive pressure circumstances in the HRT reactor cell is given. Progress made toward development and construction of the fuel processing plant is reported. Reactor Design and Analysis. Two-group two-region studies were made for 10- and 12-ft diameter spherical reactors using $D_2O-ThO_2-U^{233}O_2$ slurries in core and blanket. Results of some other analytical studies are given. Engineering Development. Progress is reported in development of fuel system components, instruments and valves, and reactor slurry systems. Corrosion and Materials. Results of thermal cycling and mechanical deflection corrosion tests on various components and materials in circulating HRT solution are given. Dynamic corrosion data for slurry runs in pump loops are reported. Circulation in toroids of thoria slurry is continuing, and corrosion rates are given. Other in-pile loop and in-pile autoclave corrosion tests are described and results given. Metallurgical development of corrosion-resistant metals is continuing. Chemical Engineering Development. Developments in fuel processing, Pu-producer blanket processing, ThO_2 slurries, and equipment decontamination are reported. Supporting Chemical Research. Studies on the $CuO-UO_3-SO_3-H_2O$ system at high temperatures are described, and the effect of UO_2^{2+} on Fe^{2+} oxidation is studied. (For preceding period see ORNL-2148.) (T.R.H.)

4693 PPWPR-15
[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England].
THE STATISTICAL WEIGHT THEOREM. D. J. Littler. July 7, 1949. Decl. Dec. 20, 1956. 3p.

A theoretical derivation is given of the statistical weight theorem which states that the change in k on placing an absorber in a pile is proportional to the square of the undisturbed density into which it is placed. (B.J.H.)

4694 YAEC-17
Yankee Atomic Electric Co., Boston.
MONTHLY PROGRESS REPORT FOR JANUARY 1957. Feb. 18, 1957. 16p. Contract AT(30-3)-222. $3.30(ph OTS); $2.40(mf OTS).

Work was continued on literature searches, core design and performance calculations, preliminary laboratory work, and conceptual studies of systems for the pressurized water reactor. (B.J.H.)

4695
LIQUID METALS AND NUCLEAR POWER. 1. C. D. Boadle (Rolls-Royce Ltd., Derby). Atomics 8, 41-5(1957) Feb.

A survey is given of the use of liquid metals as a means of high-temperature heat extraction from nuclear reactors. Data are included on the physical and nuclear properties of the various metals considered, such as Li, Na, K, Hg, Pb, Bi, and their alloys. Typical diagrams are given for liquid-metal cooled reactors. (B.J.H.)

4696
THE FRENCH APPROACH TO POWER REACTORS. THE G2 AND G3 DOUBLE-PURPOSE REACTORS. A. Ertaud. Atomics 8, 52-9(1957) Feb.

General descriptions are given of the French G2 and G3 dual-purpose reactors. They use natural U as a fuel, graphite as a moderator, and are cooled by pressurized gas. (B.J.H.)

4697
SELECT BEST HIGH-TEMPERATURE COOLANT. W. E. Parkins (Atomics International, Canoga Park, Calif.). Chem. Eng. 64, 253-6(1957) Mar.

A discussion of the advantages and disadvantages in using various materials for reactor coolants is given. (T.R.H.)

4698
CONTINUOUS PROCESSING OF HETEROGENEOUS REACTORS. Herbert H. Hyman and Joseph J. Katz (Argonne National Lab., Lemont, Ill.). Chem. Eng. Progr. 52, Symposium Ser. 19, 67-72(1956).

An unconventional approach to fuel element processing is proposed. A heterogeneous reactor lattice can be constructed of randomly packed bare uranium fuel elements, and these may be slowly dissolved in the coolant and the resulting solution continuously processed. The heterogeneous lattice using dense fuel elements yields a more efficient reactor. The continuous processing feature retains some of the advantages of a homogeneous reactor. The problems introduced by this approach are discussed. (auth)

4699
GRAPHITE AND ITS USE IN NUCLEAR REACTORS. E. Cerrai and A. Pedretti. Energia nucleare (Milan) 3, 421-34(1956) Dec. (In Italian)

4700
THERMAL AND PHYSICAL CALCULATIONS ON THE REACTOR OF THE NUCLEAR THERMOELECTRIC STATION OF THE ACADEMY OF SCIENCE OF THE USSR. D. I. Blohincev, M. E. Minasin, and Ju. A. Sergeev. Energia nuclear (Milan) 3, 450-61(1956) Dec. (In Italian)

4701
FEASIBLE CHEMICAL FORMS FOR THORIUM BREEDER BLANKET. M. H. Lietzke and R. W. Stoughton (Oak Ridge National Lab., Tenn.). Ind. Eng. Chem. 49, 202-7(1957) Feb.

Thorium blanket systems which have been seriously considered are briefly described, and general considerations in choosing a thorium breeder blanket are discussed. Various chemical systems proposed as a blanket in thorium-uranium-233 breeders with their advantages and problems are described. The only blanket form which has been demonstrated to be practical consists of aluminum-jacketed metal slugs, although reprocessing and refabrication methods used for such slugs are undesirably elaborate. Of the other systems, a thorium oxide slurry in deuterium oxide and thorium nitrate (using nitrogen-15) dissolved in deuterium oxide now appear most promising in long range. (auth)

4702
NOVEL FUEL ELEMENT FEATURE OF SCOTTISH PLANT Nuclear Power 2, No. 10, 43-7(1957) Feb.

Features of the fuel elements to be used in the proposed Scottish nuclear power plant are briefly discussed. The fuel consists of pure natural U metal fabricated in the form of cylindrical rods. The cans are of Mg alloy with finned surfaces. Fuel channels, in which the canned fuel elements are individually supported and located by non-metallic "spiders," are replaceable. Reactor design data are tabulated. (B.J.H.)

4703
BERKELEY, THE FIRST CEA STATION TO BE STARTED. Nuclear Power 2, No. 10, 48-51(1957) Feb.

A general description is given of the nuclear power station to be erected at Berkeley. (B.J.H.)

4704
HOW THE STATIONS COMPARE. Nuclear Power 2, No. 10, 54-6(1957) Feb.

Design details for the Calder Hall, Scotland, Bradwell and Berkeley power stations are compared. (B.J.H.)

4705
REACTOR PHYSICS. 9. James F. Hill (Reactor School, Harwell). Nuclear Power 2, No. 10, 67-70(1957) Feb.

Some of the changes which take place in a reactor during operation are reviewed. These include the buildup of fission product poisons, temperature, density, and pressure effects, and changes in the content of fissionable material. (B.J.H.)

NUCLEAR TRANSFORMATION

4706 AERE-N/M-59
[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England].
[MEASUREMENTS OF THE NUMBERS OF NEUTRONS EMITTED FROM THICK TARGETS OF LEAD AND URANIUM WHEN BOMBARDED WITH 147 MEV PROTONS FROM THE 110" HARWELL CYCLOTRON]. [1953?]. Decl. Dec. 20, 1956. 4p.

Experiments are described for measuring the number of neutrons emitted from thick targets of Pb and U when bombarded with 147-Mev protons. The proton beam was collimated into a 2 cm square and monitored by an integrating ion chamber. The number of neutrons emitted was measured by the activation induced in a tank of Mn solution. The number of neutrons emitted when one proton is stopped was found to be 1.55 for U and 0.83 for Pb using γ counting and 1.47 for U and 0.90 for Pb using β counting. (B.J.H.)

4707 AERE-R/R-1919
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
AN EXPERIMENTAL STUDY OF NEUTRON INDUCED ACTIVITIES IN WATER. N. Faull. May 1956. 42p.

The fast neutron reactions $O^{16}(n,p)N^{16}$ and $O^{17}(n,p)N^{17}$ of oxygen (as water) have been studied, with the results given below. The N^{16} produced in the reaction $O^{16}(n,p)N^{16}$ was found to decay with a half life of 7.2 ± 0.3 seconds, with the emission of γ rays of energy 6.2 ± 0.2 Mev, whose absorption coefficient in lead is 0.526 ± 0.016 cm^{-1}, corresponding to a half value thickness of 1.32 ± 0.04 cms. The over-all attenuation in lead of the 6.2-Mev γ rays plus the associated degraded (by scattering) radiation above 2 Mev, can also be characterized, up to an absorber thickness of 9.5 cms, by a single absorption coefficient of value $0.48_4 \pm 0.01_4$ cm^{-1}, corresponding to a half-value thickness of 1.43 ± 0.04 cms. Referred to the average thermal flux (which is itself referred to a boron cross section of 770 barns) in the uranium walls of the uranium hollow slug system within which the water was irradiated, the effective cross section for the reaction $O^{16}(n,p)N^{16}$ for the emission of 6.2-Mev γ ray was found to be 3.0 ± 0.2 microbarns. Since this γ ray is reported to be emitted in only about 80% of the N^{16} disintegrations, the actual cross section for the reaction $O^{16}(n,p)N^{16}$ is 3.8 ± 0.3 microbarns. The N^{17} produced in the reaction $O^{17}(n,p)N^{17}$ was found to decay with a half life of $4.1_6 \pm 0.1_5$ seconds, with the emission of neutrons. Referred to the same thermal flux as above, the effective cross section of normal oxygen for this neutron emission was found to be $(1.2_5 \pm 0.1_6) \times 10^{-3}$ microbarns. Since O^{17} is reported to be present in normal oxygen to the extent of only 0.039%, the actual cross section for the reaction $O^{17}(n,p)N^{17}$ is 3.2 ± 0.4 microbarns (auth)

4708
EXCITATION CURVES OF THE REACTIONS $O^{18}(p,n_0)F^{18}$ AND $O^{18}(p,\alpha)N^{15}$ FOR 2.6- AND 4.3-Mev PROTONS. Dolly Szteinsznaider, Monique Roclawski-Conjeaud, and Victor Naggiar. Compt. rend. 244, 445-7(1957) Jan. 21. (In French)

4709

NEUTRON YIELDS FROM THICK TARGETS BOMBARDED BY 24-Mev DEUTERONS AND 12-Mev PROTONS. W. E. Crandall, G. P. Milburn, and L. Schecter (Univ. of California, Berkeley). J. Appl. Phys. 28, 273-6(1957) Feb.

The gross yields of neutrons produced by 24-Mev deuterons bombarding Be, Cu, Ta, and U and by 12-Mev protons bombarding Be, Cu, and Ta were measured by detecting the neutrons in a solution of $MnSO_4$ that surrounded the targets. The yields were (in neutrons per μcoulomb): 24-Mev deuterons: Be, 1.85×10^{11}; Cu, 0.55×10^{11}; Ta, 0.52×10^{11}; U, 0.73×10^{11}; 12-Mev protons: Be, 4.1×10^{10}; Cu, 0.61×10^{10}; Ta, 0.15×10^{10}. (auth)

4710

(p,n) REACTIONS IN Mn^{55}, Co^{59}, Zn^{67}, AND Zn^{68}. R. A. Chapman and J. C. Slattery (The Rice Inst., Houston, Texas). Phys. Rev. 105, 633-8(1957) Jan. 15.

The counter ratio technique has been applied to the study of (p,n) thresholds in Mn^{55}, Co^{59}, Zn^{68}, and Zn^{67}. The ground state thresholds were found at proton energies of 1.895 ± 0.005 Mev for Co^{59}, 3.762 ± 0.005 Mev for Zn^{68}, and 1.805 ± 0.005 Mev for Zn^{67}. Thresholds were found corresponding to excited states in Fe^{55} at 0.924, 1.327, 2.16, 2.554, 2.92, and 3.76 Mev; in Ni^{59} at 0.325, 1.195, 1.776, 2.551, 3.043, 3.543, and 3.340 Mev; in Ga^{68} at 0.188, 0.342, 0.574, and 0.848 Mev; and in Ga^{67} at 0.357, 0.85, and 1.54 Mev. Absolute cross sections were measured for neutrons at 0° to the incident beam. (auth)

4711

DEUTERON-INDUCED REACTIONS FROM N^{14}, N^{15}, AND He^4. E. K. Warburton and J. N. McGruer (Univ. of Pittsburgh). Phys. Rev. 105, 639-47(1957) Jan. 15.

A study has been made of the reactions $N^{14}(d,p)N^{15}$, $N^{14}(d,t)N^{13}$, $N^{15}(d,p)N^{16}$, $N^{15}(d,\alpha)C^{13}$, and $He^4(d,p)He^5$ using 14.8-Mev deuterons. Angular distributions and stripping reduced widths were obtained for five proton groups leading to energy levels in N^{15}. The stripping reduced widths for the first two negative parity levels of N^{15} were used to gain information concerning the N^{14} ground state wave function. The absolute differential cross sections obtained for the $N^{14}(d,t)N^{13}$ reaction were compared to theoretical predictions. Nine proton groups observed from the $N^{15}(d,p)N^{16}$ reaction were assigned to levels in N^{16} at 0, 0.126 ± 0.015, 0.303 ± 0.009, 0.403 ± 0.015, 3.980 ± 0.02, 4.80 ± 0.05, 5.25 ± 0.05, and possibly at 3.53 ± 0.03 and 5.01 ± 0.05 Mev. Angular distributions were obtained for the first four levels, which have been previously reported. The four angular distributions yielded $l = 2, 0, 2, 0$ and "reduced widths" of $(2J + 1)\,\Theta^2 = 0.27$, 0.19, 0.33, 0.54 for the 0-, 0.12-, 0.30-, and 0.40-Mev levels, respectively. The results of the angular distributions were combined with theoretical predictions to give most probable values of $J^\pi = 2^-$, 0^-, 3^-, and 1^-, respectively. Ten alpha-particle groups were observed from the $N^{15}(d,\alpha)C^{13}$ reaction corresponding to previously reported C^{13} levels. The stripping reduced width obtained for the $He^4(d,p)He^5$ ground state reaction was $\Theta^2 = 0.05$, and the center-of-mass half width of the He^5 ground state was measured to be 0.55 ± 0.030 Mev. (auth)

4712

REACTION $N^{15}(p,\gamma)O^{16}$. D. H. Wilkinson, and S. D. Bloom (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 105, 683-5(1957) Jan. 15.

The reaction $N^{15}(p,\gamma)O^{16}$ has been studied up to a proton energy of 4 Mev by using a gas target and NaI(Tl) detectors. Above the well-known resonance at a proton energy of 1.05 Mev where the peak cross section is 1 mb, the cross section drops to a minimum of about 8 μb around a proton energy of 3 Mev and then increases slightly towards the higher energies. There are no pronounced new resonances and in particular the cross section up to a proton energy of about 3 Mev can be largely accounted for in terms of the high-energy tail of the 1.05-Mev resonance. There is no sign of the very strong quadrupole emission which earlier results on the inverse photodisintegration reaction had led one to expect near a proton energy of 2.8 Mev with a peak cross section of about 90 μb. Over the whole range of proton energy the gamma-ray emission is isotropic to within about 10%, and this suggests that the 13.09-Mev state of O^{16} (the 1.05-Mev resonance) is well described as $p^{-1}d$. (auth)

4713

CHARGED-PION PRODUCTION IN LITHIUM. Edwin K. Gatchell (Univ. of Rochester, N. Y.). Phys. Rev. 105, 713-17(1957) Jan. 15.

The measurement of charged-pion production cross sections in Li^6 and Li^7 is reported. The measurements were made on 40- and 52-Mev pions emitted at 90° to a proton beam of 242-Mev energy. The results show a higher π^+/π^- ratio for Li^6 than for Li^7; this observation can be qualitatively explained by the Pauli exclusion principle. (auth)

4714

SOME ASPECTS OF THE STRIPPING REACTIONS. Mohamed El Nadi (Cairo Univ., Egypt). Proc. Phys. Soc. (London) A70, 62-7(1957) Jan.

The Born approximation method for calculating the stripping cross section is applied to the (d, α) reactions, in which it is assumed that the incident deuteron picks up a proton and a neutron from the target nucleus. The angular distribution shows a peak in the forward direction. Agreement between theory and experimental curves is satisfactory. (auth)

4715

A STUDY OF THE REACTION $^{12}C(d,p)^{13}C$. N. Sarma, M. Govindjee, and H. R. Allan (Imperial Coll., London). Proc. Phys. Soc. (London) A70, 68-77(1957) Jan.

Yields and angular distributions for the reaction $C^{12}(d,p)C^{13}$ have been studied for deuteron bombarding energies between 800 kev and 1.7 Mev. It is shown that the reaction proceeds, at these energies, almost entirely through the formation of a compound nucleus, and not by a stripping process. Assignments of quantum numbers to the resonance levels observed in the compound nucleus are suggested. (auth)

4716

AN INVESTIGATION OF THE REACTIONS $^{12}C(d,n)^{13}N$ AND $^{28}Si(d,n)^{29}P$. J. M. Calvert, A. A. Jaffee, and E. E. Maslin (Univ. of Liverpool). Proc. Phys. Soc. (London) A70, 78-83 (1957) Jan.

The angular distributions of several neutron groups from stripping of deuterons on targets of C^{12} and Si^{28} have been measured, and compared with theoretical curves. The parity and possible spin of the final state have been determined for those cases showing a 'stripping distribution.' Absolute cross sections for formation of the final states were measured, and from these the reduced widths were determined for several levels in the final nuclei N^{13} and P^{29}. (auth)

4717

γ-RADIATION FOLLOWING PROTON CAPTURE IN ^{35}Cl, ^{37}Cl, AND ^{39}K. J. H. Towle, R. Berenbaum, and J. H. Matthews (Imperial Coll., London). Proc. Phys. Soc. (London) A70, 84-90(1957) Jan.

The excitation functions of the reactions Cl(p, γ)A and $K^{39}(p,\gamma)Ca^{40}$ in the region 0.8 to 1.8 Mev have been obtained using targets of natural isotopic composition. At the prominent resonances measurements with a NaI scintillation spectrometer have yielded information on the decay

schemes of A^{36}, A^{38}, and Ca^{40}. The yield of the more intense γ rays has been measured. Bound levels have been located in A^{36} at 1.95 ± 0.05 and 4.1 ± 0.1 Mev. (auth)

4718

NEUTRON PRODUCTION FROM PROTON AND DEUTERON BOMBARDMENT OF NICKEL. K. W. Jones, T. H. Kruse, J. L. Weil, J. A. Baicker, and L. J. Lidofsky (Columbia Univ., New York). Rev. Sci. Instr. 28, 56-7(1957) Jan.

Natural Ni foil targets were used with the beam from a Van de Graaff accelerator to study the Ni(p,n)Cu and Ni(d,n)Cu reactions. Cross sections for the reactions are shown graphically, and Q values are tabulated. (B.J.H.)

4719

INVESTIGATION OF THE (d,p) REACTION IN PHOSPHOROUS AND CHLORINE. I. B. Teplov (Moscow State Univ.). Soviet Phys. JETP 4, 31-5(1957) Feb.

Proton angular distributions are determined for the $P^{31}(d,p)P^{32}$ and the $Cl^{35}(d,p)Cl^{36}$ reactions using thick nuclear photographic plates. The analysis of the observed experimental results permits a number of conclusions to be made regarding the excited states of the residual nuclei. (auth)

4720

INTERACTION OF NITROGEN NUCLEUS WITH NUCLEI IN AN EMULSION. D. M. Parfanovich, N. V. Rabin, and A. M. Semchinova. Soviet Phys. JETP 4, 99-102(1957) Feb.

The results of an experimental investigation of the interaction between nitrogen nuclei, accelerated to an energy of 100 Mev, and nuclei in an emulsion are presented. The range-energy relation for nitrogen nuclei in the emulsion is determined. The angular and energy distributions for protons and α particles produced in the reactions are examined. The experimental results reveal a number of interesting features in the emission of charged particles which characterize the interaction of the nitrogen nuclei with the nuclei of the emulsion. (auth)

Refer also to abstracts 4601 and 4763.

PARTICLE ACCELERATORS

4721 AERE-GP/R-2069

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SPIRAL RIDGE CYCLOTRONS WITH FREQUENCY MODULATION. L. B. Mullett. Oct. 1956. 21p.

In order to avoid phase slip, and resonances in radial oscillations, a spiral ridge cyclotron can be operated with frequency modulation. The characteristics of such machines are considered in detail with emphasis on the maximum trapping range and duty cycle of operation. (auth)

4722 MURA-106(Suppl. 1)

Midwestern Universities Research Assn., Urbana, Ill.

BUCKET AREA PARAMETERS. Oct. 31, 1956. 4p. (MURA-KRS/AMS-1(Suppl. 1)).

4723 UCRL-3608

California. Univ., Berkeley. Radiation Lab.

PRODUCTION OF PROLONGED SECONDARY PARTICLE BEAMS IN THE BEVATRON WITH THIN FOILS. Harry G. Heard. Dec. 18, 1956. 6p. Contract W-7405-eng-48. $0.15(OTS).

A thin energy-loss foil located on the outer radius of the Bevatron aperture has been used to produce a secondary-beam pulse of up to ½-sec duration. The secondary beam pulse is reproducible from pulse to pulse and shows no time dependence due to the radio-frequency accelerating voltage. An extension of this technique permits the production of an additional short beam pulse as the current in the proton synchrotron magnet decreases. (auth)

4724 UCRL-3614

California. Univ., Berkeley. Radiation Lab.

BEVATRON OPERATION AND DEVELOPMENT. XI. [Period covered] August, September, October 1956. Walter Hartsough. Dec. 13, 1956. 20p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

Absorption cross sections were measured for antiprotons in hydrogen, Be, C, Pb, U, H_2O, and D_2O. The antineutron was detected and identified. K-meson studies continued using the 10-inch liquid hydrogen bubble chamber, counters, and nuclear emulsions. Thirty-one target bombardments in the internal proton beam were made for the chemistry group. The new wide-band rf driver was installed; two new 8-inch quadrupole magnet sets were made available for use by the experimental groups; installation of a 1-megawatt generator, for powering auxiliary bending and focusing magnets, was completed. (auth)

4725

THE 1000-MEV ELECTROSYNCHROTRON OF FRASCATI AND POSSIBLE RESEARCH WITH IT. G. Salvini. Energia nucleare (Milan) 3, 435-49(1956) Dec. (In Italian)

4726

MEASUREMENT OF THE RATIO E_m/J_m FOR BETATRON RADIATION. L. D. Skarsgard, D. V. Cormack, and H. E. Johns. Radiology 68, 257-8(1957) Feb.

RADIATION ABSORPTION AND SCATTERING

4727

DURATION OF ATOMIC COLLISIONS. Otto Oldenbert (Harvard Univ., Cambridge, Mass.). Am. J. Phys. 25, 94-7(1957) Feb.

The conventional estimate of the duration of an atomic collision is the time required to cover an atomic diameter or, if there is a force of attraction, the period of one molecular vibration. Whereas this estimate is adequate for the duration of a head-on collision it fails for eccentric collisions. These are described by "effective potential curves," which were originally introduced to represent dissociation of diatomic molecules by rotation and take into account the centrifugal force. These curves, different from the ordinary potential curves, show broad maxima outside of the well-known minima. The maxima slow down or even repel the approaching atoms. A pair of atoms whose energy carries it just to the top of a maximum may even perform a part of an unstable rotation. In the general case of eccentric collisions the durations cover a wide range between the period of a molecular vibration and the much longer period of a molecular rotation. (auth)

4728

STUDY OF NEUTRON-PROTON SCATTERING IN PHOTOGRAPHIC PLATES. F. Senent, J. Aguilar, M. de la Cuadra and L. Miralles. Anal. real. soc. espan. fis. y quim. (Madrid) Ser A 52, 267-72(1956) Nov.–Dec. (In Spanish)

Ilford C-2 emulsions exposed to the neutrons produced by the $Li^7(d,n,)Be^8$ reaction have been searched for neutron-proton elastic collisions. The main object of the present paper is to describe a method to find the angular differential cross section of the recoil protons, following the photographic technique. Results are presented for neutrons of 2.33 Mev. (auth)

4729

ANGULAR AVERAGES IN THE SCATTERING OF SLOW NEUTRONS BY GASES. Howard C. Volkin (Lewis Flight Propulsion Lab., Cleveland). J. Appl. Phys. 28, 184-9 (1957) Feb.

A procedure is developed for averaging over the thermal translational motion of a gas scatterer in order to obtain observed angular averages from a knowledge of the dif-

ferential cross section in the center-of-mass system. The results are applied to the simple case of spherically symmetrical elastic scattering with constant cross section. (auth)

4730

STATISTICAL FLUCTUATIONS IN ENERGY LOSSES OF 37-Mev PROTONS. T. J. Gooding and R. M. Eisberg (Univ. of Minnesota, Minneapolis). Phys. Rev. 105, 357-60(1957) Jan. 15.

The frequency distributions of energy losses of 37-Mev protons has been measured for a wide range of thin absorbers. The purpose of this experiment was to compare the measured distributions with the theory of Landau and Symon. The measurements required the application of both scintillation and proportional counter techniques. A simple method of unfolding the inherent resolution of the scintillation counter was developed. The observed distributions were found to be in good agreement with the Landau-Symon theory. (auth)

4731

DERIVATION OF DISPERSION RELATIONS FOR FORWARD SCATTERING. Kurt Symanzik (Univ. of Chicago, Ill.). Phys. Rev. 105, 743-9(1957) Jan. 15.

The dispersion relation for forward meson-nucleon scattering is derived in the simplified case of scalar neutral particles. Use is made of the local property of the nucleon field and of certain features of the mass spectrum. In addition, it is assumed that the only singularities of certain matrix elements of the nucleon field commutator are derivatives of finite order of δ functions on the light cone. Under some further assumptions of existence, the dispersion relations for the derivatives of the scattering amplitude with respect to angle at zero angle can also be derived. (auth)

4732

ELECTRON SCATTERING BY THE DEUTERON. Roger G. Newton (Indiana Univ., Bloomington). Phys. Rev. 105, 763-4 (1957) Jan. 15.

Brief remarks are made concerning the conclusions which are implied by electron-deuteron scattering experiments. (B.J.H.)

4733

THE CONTRIBUTION OF TENSOR FORCES TO n-α SCATTERING. A. Sugie, P. E. Hodgson, and H. H. Robertson (Univ. Coll. London). Proc. Phys. Soc. (London) A70, 1-16(1957) Jan.

The splitting of the p-phase shifts due to tensor forces is calculated for n$-\alpha$ scattering using the resonating group method and Gaussian wave functions and potentials. It is found that the tensor force can account for about 30% of the observed splitting. (auth)

4734

ELASTIC SCATTERING OF 310 Mev π^+ MESONS FROM PROTONS. E. L. Grigoviev and N. A. Mitin. Soviet Phys. JETP 4, 10-12(1957) Feb.

The angular distribution of 310-Mev π^+ mesons elastically scattered by protons in photoemulsions has been measured. The differential scattering cross section based on 427 observed cases has been obtained in the center-of-mass system. The phase analysis, taking into account only the S and P states, and assuming the Fermi solution, gave the following values for the phase shifts: $\alpha_3 = -23°$, $\alpha_{33} = 132°$, $\alpha_{31} = -9°$. The D state, apparently, contributes little to scattering in comparison with the S and P states. (auth)

4735

REMARKS ON THE THEORY OF SCATTERING OF PARTICLES WITH A GIVEN TOTAL ANGULAR MOMENTUM. V. T. Khozlainov (Academy of Sciences, USSR). Soviet Phys. JETP 4, 137-9(1957) Feb.

The scattering of two fermions interacting by means of a boson field is considered. The initial and final states of pair of fermions are specified as states with a certain given total angular momentum. (B.J.H.)

4736

POLARIZATION OF NEUTRONS SCATTERED BY CARBON TAKING NUCLEAR VOLUME INTO ACCOUNT. N. A. Guliev (Moscow State Univ.). Soviet Phys. JETP 4, 142-4 (1957) Feb.

4737

CALCULATION OF ELASTIC SCATTERING OF SLOW ELECTRONS IN HYDROGEN BY THE INTEGRAL EQUATION METHOD. V. I. Ochkur and Iu. V. Petrov (Leningrad State Univ.). Soviet Phys. JETP 4, 144-6(1957) Feb.

Refer also to abstracts 4596 and 4597.

RADIATION EFFECTS

4738 AERE-T/R-630

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A PRELIMINARY INVESTIGATION OF THE EFFECT OF IRRADIATION ON THE HALL COEFFICIENT OF AN INTRINSIC SEMICONDUCTOR. D. Luffman. Mar. 1951. Decl. Nov. 26, 1956. 12p.

A relation is found between the Hall coefficient and the number of electron traps in an intrinsic semiconductor of the graphite type. On a very simple model, and on the assumption that each vacancy produced by irradiation functions as an electron trap, the electron trap density can later be related to neutron damaging flux. It is hoped that the calculations will help to elucidate the effect of irradiation of graphite by a neutron flux. (auth)

4739 CF-56-11-1

Oak Ridge National Lab., Tenn.

RECENT DATA ON THE EFFECTS OF NEUTRON IRRADIATION ON STRUCTURAL METALS AND ALLOYS. R. G. Berggren and J. C. Wilson. Jan. 30, 1957. 31p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Data are presented from tensile and notched-bar impact tests on several carbon steels, a carbon steel weldment, a nickel steel, a high-strength steel, and a high-purity iron which were irradiated in the LITR or the MTR. It is shown that neutron irradiation increases the yield and tensile strength of structural steels, decreases their ductility, and may change the behavior of the steels to such an extent that they become unfamiliar materials for structural components. (B.J.H.)

4740 CF-57-1-119

Oak Ridge National Lab., Tenn.

REACTOR IRRADIATION OF THORIUM AND URANIUM OXIDE SLURRIES. N. A. Krohn and J. P. McBride. Jan. 29, 1957. 18p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Thorium and thorium–uranium oxide slurries were irradiated in the Low Intensity Test Reactor (LITR) at temperatures up to 300°C in small stirred autoclaves. Stirring was accomplished by means of an electromagnetically operated plunger. Stirrer operation was monitored using an oscilloscope. Relative slurry viscosities were determined both in and out-of-pile using calibration curves of apparent viscosity versus stirrer rise time. Post-irradiation examination of selected slurries indicated no gross changes occurred in the particulate properties. (auth)

4741 WADC-TR-56-296

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

NUCLEAR RADIATION OF REINFORCED PLASTIC

RADOME MATERIALS. Period Covered: March 1955 to April 1956. Robert C. Tomashot and Douglas G. Harvey. July 12, 1956. 55p. Project title: ANPP DEVELOPMENT SUPPORT PROJECT. Task title: SHIELDING MATERIALS AND RADIATION EFFECTS. (AD-97254).

Nine different reinforced plastic laminate materials, each made with a different laminating resin, and one alkyd-isocyanate foam core-glass fabric faced sandwich material were subjected to integrated γ radiation dosages up to 10^9 r. After completion of the radiation exposures, the materials were tested to determine the flexural, tensile, and compression strengths under both standard and wet conditions. The mechanical properties of the heat-resistant plastic laminates were also determined at elevated temperature. Dielectric constant and loss tangent measurements were conducted on irradiated samples to determine the effect of radiation on the electrical properties. Data obtained from these tests show that the mechanical properties were not significantly affected except for one epoxy-type resin laminate. None of the materials showed any significant change in electrical properties due to radiation. (auth)

4742 WADC-TR-56-467

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

EFFECTS OF NUCLEAR RADIATION ON STRUCTURAL ADHESIVE BONDS. Period Covered: March 1955 to April 1956. Robert S. Arlook and Douglas G. Harvey. Aug. 1956. 52p. Project title: ANPP DEVELOPMENT SUPPORT PROJECT. Task title: SHIELDING MATERIALS AND RADIATION EFFECTS.

A group of nine commercially available metal-to-metal adhesives were investigated to determine the effect of γ radiation upon their strength properties. Standard 2024-T3 alclad Al alloy lap joint specimens were prepared and three series of exposures were made at the MTR γ facility. The approximate dosages were 9×10^7, 3×10^8, and 9×10^8 r. Tensile shear and bend tests were conducted at room temperature, at 180°F, and at 260°F. Two adhesives were also tested at 500°F. Fatigue tests were performed at room temperature. Only one adhesive was essentially unaffected by γ radiation at all testing temperatures. The remaining adhesives were affected to varying degrees. (auth)

4743

ANNEALING OF COLD-WORKED COPPER BY ELECTRON IRRADIATION. C. J. Meechan (Atomics International, North American Aviation, Inc., Canoga Park, Calif.). J. Appl. Phys. 28, 197-200(1957) Feb.

Copper wires were cold worked at room temperature to approximately a 15% reduction in area and were then irradiated at temperatures between 100 and 150°C with 1.25-Mev electrons. The residual resistivity was observed to decrease as a function of exposure at temperatures above 100°C. The higher the temperature at which the irradiation was performed, the greater was the rate of resistivity decrease. From these data, it is concluded that one of the primary defects produced by electron irradiation becomes mobile in the temperature range, 100 to 150°C. It is suggested that interstitials and vacancies produced by the irradiation initiate a process which results in the annihilation of dislocations. From an analysis of the temperature dependence of the rate of decrease, a value for the activation energy for vacancy migration in copper has been deduced: 1.28 ± 0.10 ev. (auth)

4744

THE EFFECT OF GAMMA IRRADIATION ON THE YOUNG'S MODULUS OF COPPER. D. O. Thompson and D. K. Holmes (Oak Ridge National Lab., Tenn.). Phys. and Chem. of Solids 1, 275-8(1957) Jan.

Copper single crystals have been subjected to irradiation with 1.2 Mev Co^{60} gamma rays at room temperature. This irradiation causes an increase in the Young's modulus and a decrease in the internal friction. These effects are quantitatively consistent with an interpretation on the basis of the pinning of dislocation lines by lattice defects which migrate to the dislocation line from the point at which they are originally produced through the Compton and photoelectrons resulting from the incident gamma rays. Comparison with previous work shows that for each primary displaced lattice atom only one eightieth as many pinning points result from the gamma ray bombardment as from bombardment with fast neutrons; this result is in satisfactory agreement with calculations of higher order displacements in the two cases. (auth)

4745

RADIATION DAMAGE EXPERIMENTS IN III-V-COMPOUNDS. U. Gonser and B. Okkerse (Univ. of Illinois, Urbana). Phys. Rev. 105, 757-9(1957) Jan. 15.

Two samples of GaSb and one of InSb were irradiated with approximately 2×10^{17} 12-Mev deuterons/cm^2. During irradiation the resistance of the specimens increased sharply and then slowly decreased with increasing integrated flux. After irradiation, x-ray techniques were used to study the radiation effects. (B.J.H.)

Refer also to abstract 4514.

RADIOACTIVITY

4746

DECAY OF Sn^{125} (9.7-DAY AND 9.4-MINUTE). S. B. Burson, J. M. LeBlanc, and D. W. Martin (Argonne National Lab., Lemont, Ill.). Phys. Rev. 105, 625-33 (1957) Jan. 15.

The β and γ radiations of the 9.7-day and 9.4-minute radioactive decays of Sn^{125} have been studied by scintillation methods using multichannel coincidence spectrometers. Sources were prepared by thermal-neutron irradiation of metallic tin foil enriched in Sn^{124}, followed by chemical purification. In the 9.7-day activity, seven γ rays of energies 0.342, 0.468, 0.811, 0.904, 1.068, 1.41, and 1.97 Mev are observed. Their intensities, expressed in percent of the total decay to excited states, are 9, 10, 20, 18, 73, 3, and 24 respectively. The presence of four β-ray components is deduced; their energies are 2.35, 1.28, 0.47, and 0.38 Mev, with log ft values of 8.9, 9.8, 7.9, and 7.7 respectively. There is a possible weak fifth component of 0.94 Mev with log ft about 10.4. The coincidence data define a decay scheme involving excited states in Sb^{125} at 1.07, 1.41, 1.88, and 1.97 Mev, with the strong (~95%) 2.35-Mev β ray proceeding directly to the ground state. All these excited states surely have spins of at least $^9/_2$, and all probably have positive parity. In the 9.4-minute decay, four γ rays of 0.326, 0.64, 1.07, and 1.39 Mev are observed. Their intensities, expressed in percent of the total decay, are 99.7, 0.3, 0.3, and 1.9 respectively. The first and last are coincident, and define an excited level at 1.72 Mev. The principal β component of 2.05 Mev proceeds to the intermediate level at 0.326 Mev. The β component to the 1.72-Mev level has therefore an energy of 0.66 Mev and log ft of 5.8, so the level has a low spin and probably positive parity. The two weak γ rays are also found to be in coincidence, with an energy sum of 1.72 Mev. The intermediate state of this cascade could be at either 1.07 or 0.64 Mev. Since it must be of fairly low spin, it apparently cannot be identical with the 1.07-Mev level observed in the 9.7-day decay. (auth)

4747
RADIOACTIVE DECAY OF Ne^{23}. J. R. Penning and F. H. Schmidt (Univ. of Washington, Seattle). Phys. Rev. 105, 647-51(1957) Jan. 15.

The β and γ radiations of 38-sec Ne^{23} have been studied by means of scintillation spectrometer techniques. Beta transitions were found to the ground, first, and second excited states of Na^{23} with end-point energies equal to 4.39 ± 0.05, 3.95 ± 0.05, and 2.4 ± 0.1 Mev, respectively. Their percent intensities and log ft values are: 67 ± 3, 5.25; 32 ± 3, 5.38; and 1.00 ± 0.15, 5.88, respectively. Gamma rays are coincident with the latter two beta transitions and with one another; their energies and percent relative intensities are: 436 ± 4 kev; 100; 1647 ± 16 kev, 3.0 ± 0.3, respectively. Higher energy gamma radiation was present in less than 0.2% of all decays. No beta transitions with log ft values in the superallowed group were found. A decay scheme based on the above data is proposed. The half life of Ne^{23} was remeasured together with the half lives of O^{15} and Ne^{19}. The results are: Ne^{23}, 37.6 ± 0.1 sec; O^{15}, 123.95 ± 0.50 sec; Ne^{19}, 17.7 ± 0.1 sec. (auth)

Refer also to abstracts 4565 and 4619.

RARE EARTHS AND RARE-EARTH COMPOUNDS

4748 ISC-701
Ames Lab., Ames, Iowa.
MAGNETIC PROPERTIES OF HOLMIUM AND THULIUM. B. L. Rhodes, Sam Legvold, and F. H. Spedding. Dec. 1955. 62p. Contract W-7405-eng-82. $0.40(OTS).

The magnetic properties of metallic holmium, 99.6% pure, and of metallic thulium, 99.4% pure, have been measured. The applied magnetic fields for this study were between 1,000 and 18,000 oersteds; the temperatures observed were in the range between 4.2°K and 300°K. The experimental results indicate that both metals exhibit regions of paramagnetic (P) and antiferromagnetic (A) behavior. The Néel temperature for Ho was estimated to be 1.33 ± 2°K, and for Tm 50.5 ± 1.0°K. Each of the metals showed behavior immediately below the Néel temperature that was very similar to the reported behavior of dysprosium. The ferrogmagnetic state was attained in holmium at 4.2°K, but the data between 20.4°K and 4.2°K were not available to determine the Curie point. Holmium showed considerable magnetic hysteresis in the temperature region below the Néel point. Thulium metal also showed magnetic hysteresis in the temperature region below the Néel point, but did not attain a ferromagnetic state in the temperature region of these investigations. Values of the magnetic moment were observed for both metals that were larger than spin-only contributions would yield. Such observations indicate that there exists orbital contributions to the magnetic moment of the atoms of the elements studied. In the paramagnetic region, holmium obeyed explicitly the Curie-Weiss law $\chi_A = 14.8/(T-87)$ with an indicated Bohr magneton number of 10.9. The theoretical calculations for the Ho tri-positive ion with a spectrographic state $^5I_8$ would indicate a value of 10.6. The difference between the two values is thought to be due to impurities in the sample or to exchange interactions between the atoms of the metal. In the paramagnetic region, thulium obeyed explicitly the Curie-Weiss law $\chi_A = 7.26/(T-20)$ with an experimental Bohr magneton number of 7.6. This value is identical with that calculated for the spectrographical state of the tri-positive Tm ion $^3H_6$. Holmium, of the two metals studied, revealed the more interesting magnetic behavior because, principally, temperatures well below the Néel point were attained. Throughout the study the Ho metal showed magnetic behavior very similar to that of Dy. (auth)

4749 AEC-tr-2825
THE FINE AND SUPERFINE STRUCTURE OF PARAMAGNETIC RESONANCE IN DIVALENT EUROPIUM. A. A. Manenkov and A. M. Prokhorov. Translated by T. Turton from Doklady Akad. Nauk S.S.S.R. 107, 402-4(1956).

4750
THERMAL EXPANSION OF RARE EARTH METALS. F. Barson, S. Legvold, and F. H. Spedding (Iowa State Coll., Ames). Phys. Rev. 105, 418-24(1957) Jan. 15.

Thermal expansion measurements at temperatures ranging up to 900°C for polycrystalline samples of La, Ce, Pr, Nd, Gd, Tb, Dy, Er, and Yb metals are reported. La, Ce, Pr, and Nd exhibit plastic flow properties at temperatures well below their melting points. High-temperature phase transformations are reported for Pr, Nd, and Yb. The coefficient of expansion for Yb is found to be three times as large as the coefficients for the other metals reported. Negative coefficients are observed near the Curie points of Gd, Tb, and Dy. (auth)

4751
A RE-MEASUREMENT OF THE $L\alpha_{1,2}$ LINES OF LANTHANUM. P. C. Russell and E. A. Stewardson (Univ. of Coll. of Leicester). Proc. Phys. Soc. (London) A70, 91-2(1957) Jan.

A focusing x-ray spectrometer with a muscovite mica crystal bent to a nominal radius of 200 cm was used to remeasure the $L\alpha_{1,2}$ lines of La. The results give wave lengths of 2660.96 X.U. and 2669.71 X.U. for the $L\alpha_1$ and $L\alpha_2$ lines respectively. (B.J.H.)

4752
THEORY OF NUCLEAR MAGNETIC RESONANCE IN Eu^{3+}. R. J. Elliott (Reading Univ.). Proc. Phys. Soc. (London) B70, 119-23(1957) Jan.

A calculation is made of the splitting of the energy levels of Eu^{3+} ions in their ground state which arises from the interactions of the nuclear magnetic moment with external and internal magnetic fields and of the nuclear quadrupole moment with the crystalline electric field. The feasibility of determining these nuclear properties by nuclear magnetic resonance is discussed. The method is applicable to all paramagnetic substances with singlet ground states. (auth)

SHIELDING

4753 SWP/P-17
[Gt. Brit. Atomic Energy Research Establishment Harwell, Berks, England.]
AN OPTICAL ANALOGUE FOR SOLVING DUCT STREAMING PROBLEMS. B. T. Price. Jan. 20, 1955. Decl. Dec. 20, 1956. 3p.

Problems of neutron streaming in reactor shield ducts may be simplified by the construction of an optical model. The model proposed would be constructed of silvered-glass ducts containing small glass and steel balls. (D.E.B.)

Refer also to abstract 4658.

SPECTROSCOPY

4754 AEC-tr-2830
CERENKOV EFFECT IN OPTICS AND IN THE MICROWAVE REGION. M. Abele. Translated by K. S. Bevis from Nuovo cimento (9), 9, Suppl., 207-13(1952). 7p.

The utilization of the Cherenkov effect in producing a

centimeter or millimeter wave-length spectrum is discussed. (B.J.H.)

4755

MOLECULAR ELECTRONIC SPECTROSCOPY. M. Kasha and S. P. McGlynn (Florida State Univ., Tallahassee). Ann. Rev. Phys. Chem. 7, 403-24(1956).

The subject, "Spin Intercombinations in Molecules," is reviewed. The sub-topics included are: Photomagnetism Studies; Radiationless Transitions; Inter-system Crossing; Triplet States; Triplet → Singlet Emission Studies; Singlet → Triplet Absorption Spectra; Triplet → Triplet Absorption Spectra; Intermolecular Spin-Orbital Perturbations; Intercombinations in Photochemical and Chemical Reaction Mechanisms; Thermochromism and Photochromism. (T.R.H.)

4756

VIBRATION-ROTATION SPECTROSCOPY. Ralph S. Halford and Isao Ichishima (Columbia Univ., New York). Ann. Rev. Phys. Chem. 7, 425-44(1956).

A review of recent literature on vibration-rotation spectroscopy is presented. (T.R.H.)

4757

LIGHT-SCATTERING AND COLOR CENTERS IN SODIUM CYANIDE. Giovanni Isetti and Theodore J. Neubert (Illinois Inst. of Tech., Chicago). J. Chem. Phys. 26, 337-44(1957) Feb.

4758

HIGH RESOLUTION NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY AT ELEVATED TEMPERATURES. J. N. Shoolery (Varian Associates, Palo Alto, Calif.) and John D. Roberts (California Inst. of Tech., Pasadena). Rev. Sci. Instr. 28, 61-2(1957) Jan.

Descriptions are given of a device for heating samples in nuclear magnetic resonance spectrometers. (B.J.H.)

Refer also to abstract 4752.

THEORETICAL PHYSICS

4759

COMMENT ON RECENT CAVITY IONIZATION THEORIES. P. R. J. Burch (Univ. of Leeds, Eng.). Radiation Research 6, 79–84(1957) Jan.

4760

ON THE PROBLEM OF UNQUANTIZED RELATIVISTICALLY INVARIANT RENORMALIZED EQUATIONS FOR A THREE-DIMENSIONAL EXTENDED PARTICLE. Iu. M. Shirokov and D. G. Sannikov (Moscow State Univ.). Soviet Phys. JETP 4, 13-19(1957) Feb.

A system of relativistically invariant equations for a smeared-out particle interacting with a field has been obtained by using a method for constructing a three-dimensional extended particle. The conservation laws for the total energy-momentum four-vector are formulated. The particle is stable without the necessity for introducing additional forces (of the Poincare pressure type). An exact mass renormalization is carried out. For comparison with earlier equations, a rigorous limiting transition to the case of a point particle is made. Interaction with the electromagnetic field and with a scalar meson field are considered. (auth)

URANIUM AND URANIUM COMPOUNDS

4761 AERE-M/R-1075

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE CONTROL OF URANIUM FIRES. H. Lloyd. Dec. 9, 1952. Decl. Dec. 20, 1956. 24p.

Fires have occurred in the production, storing, handling and shipping of uranium powder and turnings. Batches of uranium powder, swarf and solid scrap have been ignited to observe fire temperatures and combustion rates and materials and methods to suppress or extinguish uranium fires investigated. The effect on various metals in contact with burning uranium has also been examined. The uranium content of the fire fumes was assessed. Recommendations are given for storing and shipping these materials. (auth)

4762 AERE-R/M-98

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE BUILD-UP OF URANIUM ISOTOPES BY IRRADIATION OF U-233. W. G. Davey. Oct. 1956. 9p. (LMFS/P-6).

The buildup of higher isotopes by neutron irradiation of U^{233} is analyzed using 2200 meter/sec neutron cross sections. (B.J.H.)

4763 UCRL-4735

California. Univ., Livermore. Radiation Lab.

THERMAL-NEUTRON-CAPTURE GAMMA-RAY SPECTRUM FROM U^{238}. R. W. Kenney and J. T. Mattingly. Oct. 30, 1956. 13p. Contract W-7405-eng-48. $0.20 (OTS).

The prompt γ-ray spectrum initiated by thermal neutron capture in U^{238} was measured by observing the photon spectrum from a target of U^{238} placed in the Water Boiler Neutron Source thermal neutron beam. The photon detector was a three-crystal scintillation spectrometer of conventional design. Three gamma-ray lines were identified. Their energies and their production cross sections were found to be, 4.0, 5.9, and 7.5 Mev and 1.3, 0.2, and 0.1 barns respectively. The spectral shape corresponds to class 2-b of Mittelman, and is typical of heavy elements. (auth)

4764 UK/C/5/6

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

CROSS SECTION CHANGES IN NRX-IRRADIATED NATURAL URANIUM BARS. J. E. Sanders. Oct. 12, 1956. 5p.

Measurements made on the cross section change produced in natural U bars as a result of irradiation in the NRX Reactor are outlined. The cross sections of the bars were measured on the GLEEP oscillator. The observed cross section changes are in reasonable agreement with predicted values. (B.J.H.)

4765 WAPD-TM-22

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

THEORY OF LOCAL ATOMIC DISPLACEMENTS IN SOLID SOLUTIONS OF URANIUM ALLOYS. R. B. Roof, Jr. Dec. 14, 1956. 15p. Contract AT-11-1-GEN-14. $0.20(OTS).

A local static displacement in solid binary solutions occurring within a distance of one atom from the ideal lattice and completely independent of the thermal effects was determined, based on the measurements of the Bragg intensities. The measured intensities were corrected for multiplicity, Lorentz and polarization effects, and a set of structure factors on an arbitrary scale were calculated. Values of $\ln(F_c/F_o)$ were plotted against $\sin^2\theta/\lambda^2$ and the best straight line through the experimental points has been derived by the method of least squares. Applications of theory to solid solutions of U alloys are discussed. (R.V.J.)

4766 IGRL-T/C-31

PREFERRED ORIENTATIONS PREDICTABLE IN α URANIUM. C. Fizzotti. Translated by E. G. Peters from Energia nucleare (Milan) 3, 102-12(1956). 13p.

Causes of plastic deformation in a polycrystalline aggregate, the orientation of crystallographic planes, and directions resulting from certain types of deformation were investigated. A graphic method was used in studies of the various systems of twinning, slip, and kinking, and the areas in which the various systems apply, as well as the effect on the texture produced by each of them were examined. The temperature effects on the systems and the textures were investigated, and the orthorhombic α-uranium predictable orientation is discussed. (R.V.J.)

4767

STUDY OF ORDINARY FISSION OF URANIUM BY PHOTOGRAPHIC EMULSIONS. J. Catala, J. Casanove and M. de la Cuadra. Anal. real. soc. espan. fis. y quim. (Madrid) Ser. A 52, 259-66(1956) Nov.–Dec. (In Spanish)

4768

HYDROGEN COOLED UH_3 MULTIPLYING SYSTEMS. M. Silvestri (CISE laboratories, Milano). Energia nucleare (Milan) 3, 471-4(1956) Dec.

It is well known that H_2 gas is a good cooling agent, as well as a good moderator. From this point of view, metal hydrides seem to have interesting applications in multiplying systems, provided they can operate in thermal stability conditions. Properties of uranium hydride itself are examined along these lines. (auth)

4769

RESONANCE ABSORPTION OF NEUTRONS BY URANIUM CYLINDERS. Monte V. Davis (General Electric Co., Richland, Wash.). J. Appl. Phys. 28, 250-4(1957) Feb.

The integrated effective resonance neutron absorption cross section of uranium-238 cylinders has been experimentally investigated in the Hanford Test Pile. The results of reactivity measurements were interpreted to yield the effective resonance integral as a function of the surface-to-mass ratio of the uranium cylinders. The experiments were extended to determine the Doppler coefficients resulting from heating the uranium in a constant neutron spectrum in the reactor. (auth)

4770

PREFERRED ORIENTATION IN EXTRUDED URANIUM ROD. L. K. Jetter and C. J. McHargue (Oak Ridge National Lab., Tenn.). J. of Metals 9, 291-2(1957) Feb.

The deformation texture of uranium rod extruded at 500°C is duplex—the components being near <031> and 10° from <410>. Increasing amounts of deformation result in shifts from these positions toward <010> and <410>, respectively. The <031> component appears to be favored for low amounts of deformation and the near <410> component for high reduction. The texture for uranium rod extruded at 500°C and annealed at 550°C is also duplex—one component near <431> and the other component being 13° from <100> and 17° from <410>. (auth)

4771

NEUTRON RESONANCE STRUCTURE OF URANIUM-238. L. M. Bolinger, R. E. Cotέ, D. A. Dahlberg, and G. E. Thomas (Argonne National Lab., Lemont, Ill.). Phys. Rev. 105, 661-5(1957) Jan. 15.

Modifications in the Argonne fast-neutron chopper and its installation at the reactor CP-5 are described. With this system, neutron transmissions of very pure samples of U^{238} were measured. Parameters for the resonances observed were obtained by a refined wing shape analysis as well as by the conventional area analysis. A previously unobserved level having a smaller reduced neutron width than any heretofore reported was detected at 10.2 ev; it is interpreted as being a p-wave resonance. Average parameters of significance to nuclear theory are deduced. For reactor application, the resonance capture integral is calculated from the parameters and is found to be in excellent agreement with the directly measured value. (auth)

Refer also to abstract 4513.

PATENTS

PHYSICS

4772

NUCLEAR REACTOR. Stichting voor Fundamenteel Onderzoek der Materie, Utrecht. British Patent No. 751,700, July 4, 1956. Nuclear Power 2, No. 10, 77(1957) Feb.

Relating to homogeneous reactors, the novel feature of this invention is the use of a shield containing bismuth. This material is suitable for shielding because it has a very high absorption capacity for electromagnetic radiations, and it is said that 40 cm of bismuth metal is equivalent to 150 cm of concrete. This would result in a much smaller plant. The invention is claimed to be of advantage when bismuth is used as a reflector (it has a low neutron capture cross section combined with a high scattering cross section). Thus the shield may be combined with the reflector. Cooling of the shield would of course be necessary and the invention includes means for doing this. A typical application is described in some detail. (auth)

4773

IMPROVEMENTS IN NUCLEAR CHAIN REACTORS. Allemanna Svenska Elektriska AB, Vasteras, Sweden. British Patent No. 754,183. Nuclear Power 2, No. 10, 77(1957) Feb.

Using tubular fuel elements, this reactor is liquid-metal cooled and heavy-water-moderated. The liquid metal such as sodium is circulated through the hollow elements which are clad on the outside with a double tube of zirconium or other suitable material. The space between the two cladding tubes is filled with gas such as helium. This reduces heat loss to the heavy water moderator which is kept at a low temperature—below 100°C. An alternative fuel element consists of a solid rod, the liquid metal coolant passing between it and the inner cladding skin. (auth)

4774

IMPROVEMENTS IN DEVICES FOR THE EVACUATION OF HEAT. Société Rateau, Paris. British Patent No. 755,291, Aug. 22, 1956. Nuclear Power 2, No. 10, 77(1957) Feb.

By way of illustration, the invention is applied to cooling a horizontal cylindrical gas-cooled reactor core. The core is in two separate cylinders separated by a space and the coolant channels in each half are horizontal. Coolant is supplied through an annular volute chamber surrounding the core and reaches the central space through curved vanes. On passing through the fuel channels, the heated gas is removed at both ends of the core through collecting chambers. In its passage through the volute casing and the vanes to the center of the core the velocity decreases and the static pressure increases. Thus, channels near the periphery will receive less coolant than the center ones. Since the heat output is greater in the center, this gives a more uniform rate of heat removal. The system thus acts as a form of diffuser, the efficiency being aided by the fact that the coolant channels are exercising a continuous boundary layer control. Further refinements of slot geometry are possible and are indicated in the specification. (auth)

4775

IMPROVEMENTS RELATING TO THE UTILIZATION OF THE NUCLEAR COMBUSTION OF HYDROGEN. G. F. Hemens, London. British Patent No. 755,903, Aug. 29, 1956. Nuclear Power 2, No. 10, 77(1957) Feb.

According to this invention, water and other hydrogen-containing substances can be made to combine nuclearly with nitrogen, the air-water reaction being mentioned specifically. This H-N reaction constitutes the second half of the Bethe-Weizsäcker cycle which is held to be responsible for the energy release in the sun and stars. From his interpretation of published accounts of nuclear weapon test explosions, the patentee concludes that, in a secondary effect of the bomb, a H-N reaction takes place in the water vapor cloud and he concludes that such a reaction could be initiated with a temperature of about 7,000°C instead of the several millions commonly held to be necessary. It is proposed to initiate such reactions by the use of an ordinary high explosive containing a small quantity of tritium, deuterium or lithium compounds. This could even be in the form of a match. The specification describes apparatus in which the reaction might be performed. (auth)

4776

IMPROVEMENTS IN OR RELATING TO REACTORS EMPLOYING NUCLEAR FISSIONABLE MATERIAL. Westinghouse Electric International Co., New York. British Patent No. 756,014, Aug. 29, 1956. Nuclear Power 2, No. 10, 77 (1957) Feb.

The proposed reactor uses fuels in the form of a bed of discrete pellets some at least of which contain fissionable material. These are contained on a perforated tray in a pressure vessel through which a coolant is passed. At rest, the pellets are in a sub-critical condition but on the introduction of a coolant-fluid the bed is fluidized and the pellets are moved into such a position that the reaction becomes divergent. The fluid may act as a coolant, moderator or both. The reactor is claimed to be inherently safe because failure of the fluid pumping system will result in the collapse of the fuel bed, thus decreasing the fuel-moderator ratio and bringing subcriticality. Means are described in the specification for the removal of pellets for reprocessing and for charging of fresh ones. (auth)

4777

IMPROVED METHODS OF AND MEANS FOR CONVERTING THE ENERGY OF NUCLEAR RADIATIONS INTO USEFUL ELECTRICAL ENERGY. Radio Corporation of America, New York. British Patent No. 761,404, Nov. 14, 1956. Nuclear Power 2, No. 10, 77(1957) Feb.

An electric battery may be formed by irradiating semiconductors with ionizing radiations. In its simplest form the invention comprises a source of radiation and a p-n junction device, either of the 'grown' or the alloy types. The source may be: polonium or uranium (alpha emitters), strontium-90 or tritium (beta emitters) or cobalt-60 (gamma). For the junction, if n-type germanium is used, the material for the p-region may be indium, boron or gallium. If p-type germanium or silicon is used, the alloy material may be lead, antimony, or gold-antimony. Point contact transistors may also be used. The radiations from the source interact with the valence bonds, causing charge carriers (electrons and holes) to be liberated within the solid. If the energy quanta are sufficient, these charge carriers take part in a current induction process. Quoted as an example, with a 50 millicuries Sr^{90} source the open circuit voltage in a germanium transistor is 30mv; with silicon, it is 200mv. The advantage of the system is the very small size of the battery—of the order of a fraction of a cubic cm. It is also very robust and as a primary source of energy it is limited only by the life of the source. Further developments of this principle embodying a number of junctions are described. (auth)